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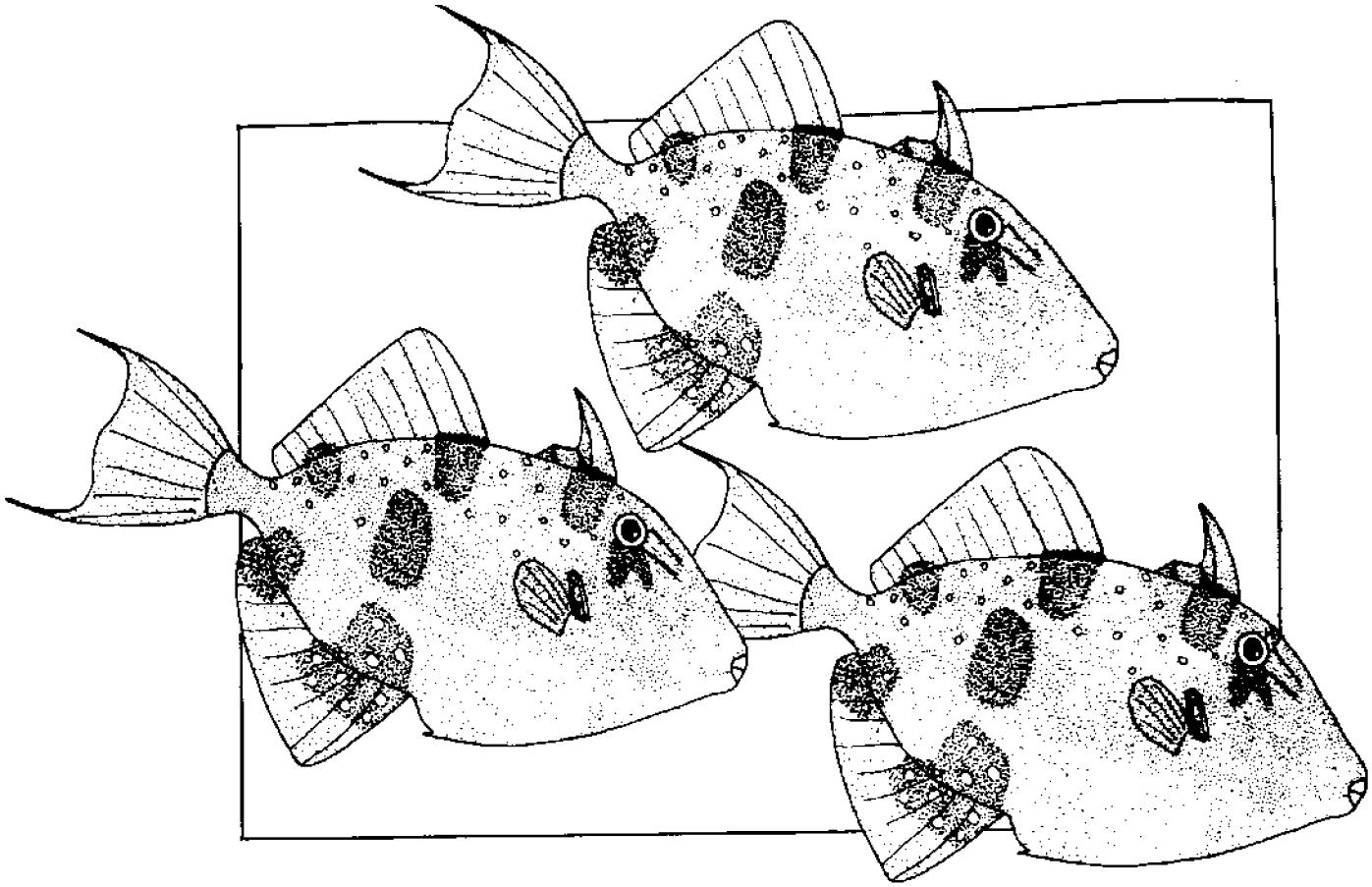

Perceptions and Preferences For Marine Fish

A Study of Recreational Fishermen In the Southeast

Jeffrey C. Johnson
David C. Griffith

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PERCEPTIONS AND PREFERENCES FOR MARINE FISH: A STUDY OF RECREATIONAL FISHERMEN IN THE SOUTHEAST

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and

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INTRODUCTION

Growth in marine recreational fishing has risen steadily over the past decade. An estimated 15 to 20 million anglers now participate. Over five million individuals pursue saltwater fishing in the Gulf and South Atlantic states (NMFS, 1979). Between 30 and 35 percent of the total finfish poundage harvested for food in the United States is caught by marine recreational fishermen (NMFS, 1981). Expenditures by these fishermen contributed significantly to the U.S. economy.

Recreational and commercial fishermen often seek the same species of fish (e.g., striped bass, bluefish and flounder along the Atlantic coast, and for redfish along the Gulf coast), often cuasing conflict between the two groups Among the major responsibilities of fisheries managers is that of allocating fisheries stocks among various commercial and recreational harvestors (Beaumarriage, 1978). These allocations are designed to reduce the inevitable conflicts that result when demand exceeds supply.

Many underutilized species in the marine waters of the south Atlantic and Gulf states presently are not harvested to capacity. These species include Atlantic bonito, sea catfishes, herrings, jack crevalle, jacks, ladyfish, atlantic mackerels, tunas, sea robins, dogfish, skates and rays, and toadfish. Conflicts between commercial and recreational fishermen for traditionally sought species can be reduced if these groups can be induced to harvest underutilized species.

Government agencies and fisheries development foundations (e.g., Saltonstall/Kennedy funds) have spent much money or have paid a heavy price in recent years to encourage commercial harvesters to tap underutilized fisheries stocks. Economic incentives have been used to encourage this activity. Federal and state agencies, fishery development foundations, universities and members of the fishing industry have worked on the bottlenecks of developing a sustained fishery for underutilized stocks. These bottlenecks have appeared in the harvesting, processing and marketing sectors. Very little effort, if any, has been spent to encourage the recreational sector to harvest underutilized species.

Sportfishing incentives differ. A review of several studies by Dawson (1979) indicated that a wide variety of reasons for sport fishing exists and the relative importance of each reason varies with different types of fishermen. However, in each of the five studies reviewed, catching and eating a fish were commonly cited as important reasons for fishing (Dawson, 1979; Johnson, in preparation).

A recent study in Florida indicates that 90 percent of fishermen ate the top five species caught by recreational fishermen (Bell, et al., 1982). The sixth most frequently caught species, sea catfish, was eaten only 26 percent of the time. Evidently, sport fishermen do not perceive sea catfish as a highly edible fish even though over 21 million sea catfish were caught in the Gulf and South Atlantic in 1979. This means that 15 million were released or thrown away, adding up to a considerable loss of protein. Many other species are treated similarly. Table 1 lists some of

these species in the Gulf and South Atlantic states and shows the number of fish caught between January 1 and December 1, 1979. Of the total number of fish caught in these regions, 16.8 percent and 19.5 percent respectively. In another Florida study, Southerland interviewed anglers on four fixed platforms in the St. Andrew Bay system. At three of the locations, throwbacks ranked as first (22.8 percent), second (22.3 percent) and third (18.6 percent), respectively, of the total catch at those locations (Southerland, 1973).

Since these underutilized or "throwback" species are frequently caught it is evident that fishermen need to develop a more positive attitude about the value of these species. A positive attitude could have a favorable effect on the overall recreational experience since fishermen particularly enjoy catching fish. This would, in turn, have beneficial effects on local economies dependent on revenues from sport fishing and related activities.

Factors influencing the responses of anglers towards underutilized species vary from region to region. A species considered good eating in one region may be considered a trash fish in another. The confusion surrounding certain species and their culinary characteristics often results because of folk beliefs or socioeconomic considerations. These misconceptions are evident in even the most knowledgeable and well respected sources of information available to anglers. For example, in the April 1983 issue of Saltwater Sportsman, two articles contradict one another with respect to the edible characteristics of amberjack. One article stated: "Amberjack are edible but the numerous worms usually found in their flesh turn off all but the most dedicated. Therefore, the best thing to do with them is turn them loose." (Ristori, 1983:87).

Table 1. Estimated total number of fish caught by marine recreational fishermen by species group and subregion, January 1979-December 1979 (for selected underutilized species).

	South Atlantic	Gulf
Bonito, Atlantic	69,000	142,000
Catfishes, Sea	5,517,000	14,993,000
Herrings	2,927,000	2,142,000
Jack, Crevalle	351,000	1,204,000
Jacks	852,000	907,000
Ladyfish	105,000	761,000
Mackerels and Tunas	126,000	144,000
Searobins	655,000	128,000
Sharks, Dogfish	54,000	80,000
Skates and Rays	172,000	621,000
Toadfishes	295,000	202,000
	11,123,000	21,324,000

Source: Marine Recreational Fishery Statistics Survey, Atlantic and Gulf Coasts, 1979. NMFS, Washington, D.C. 1980.

An article in a later section of the same magazine stated:

> "And commercial fishermen have never established a market for this fish, which is perfectly good to eat. One old fisherman lamented the fact he couldn't find a restaurant that would even try amberjack. His amberjack were either released, eaten at home or carved up for bait. Like many snapper fishermen who sell their catch, he eventually found that amberjack left over from the fish box were good to eat, with a minimum of red meat." (Richard 1983:59)

This is just one example where confusion exists about the positive and negative characteristics of an underutilized species that could, with some educational effort, become a highly desired recreational target species.

This study develops informant-based models of marine recreational fishermen's perceptions of the fish available in the marine waters of the Southeastern United States. The study pays particular attention to the influences of perceived characteristics or attributes ultimately affecting fishermen's preferences for various species.

METHODS

MDS and Clustering

In exploring recreational fishermen's perceptions of species, we incorporate methods and theories from the fields of anthropology and marketing and consumer research. Two statistical techniques, which have been of particular importance to certain research aspects in the disciplines above and are similarly applicable here, are multidimensional scaling (MDS) (Kruskal 1964) and hierarchical clustering (HCL) (Johnson 1967). Generally, any items that can be compared on the basis of similarity or dissimilarity can be represented visually as points spatially distributed in euclidian space (MDS) or as items grouped together hierarchically as a taxonomic structure(HCL). Both techniques display relationships among items or stimuli (e.g.,different kinds of fish) based on measures of similarity/dissimilarity.

In this study, for example, we use these techniques to explore fishermen's judged similarities between selected saltwater fish. Fishermen determined the similarities among these fish by sorting cards with pictures and names of fish on them into piles on the basis of how they perceived species to be similar to one another.[1] Consequently, the common group memberships among species, the relationships among the groups, and the derived similarity measures between the species were determined by how the fishermen sorted species into piles. Two methods for deriving similarity data from the pile sorts were explored. The first is based on information theory and tends to emphasize minor distinctions made by subjects(Burton 1972). The second is based on the summing of co-occurance of items(stimuli) in a pile across all subjects(Weller 1984). Comparisons and tests of both techniques convinced

us that, for our purposes, the latter provided a better measure of similarity for use with these statistical procedures.[2]

Although multidimensional scaling and hierarchical clustering display similarity and difference between stimuli, each produces a different result because of the steps used to examine and display the relationships among the stimuli.

Multidimensional scaling measures the proximities, or distances, between objects by examining each object's relationship to every other object and plotting these relationships graphically in a configuration of points, usually in euclidean space. The resulting configuration of points can be analyzed with regard to the proximities between the points or with regard to dimensionality. For example, if an object appeared in the same group with another object 100 percent of the time, these objects would have identical coordinates in all dimensions. We could assume that these two objects were similar to the point of being identical in all respects. However, with a group of stimuli such as fish, which can vary by size, taste and fighting characteristics, we can expect respondents who are knowledgeable about the stimuli to view some stimuli as similar across all characteristics, others as similar in one characteristic but not another, and some dissimilar in all characteristics together. This kind of sorting behavior yields relationships among the objects such that one object is similar to another object, but more or less similar to a third, and so on. Each object's coordinates or point on the configuration produced by MDS (displayed in relation to vertical and horizontal axes) reflects these degrees of similarity and difference. On the configuration, those objects which were perceived to be similar by respondents will be closer together on the configuration. Those objects which were perceived to be different will be further apart.

Hierarchical clustering analysis also examines each object's relationship to every other object. Instead of plotting them in space, however, clustering analysis groups objects together on the basis of the strength or weakness of their relationships in a hierarchy or rank order. All of the objects or stimuli in our research are related to one another at a general level because all are species of saltwater fish. A lower level in the hierarchy, or a subset of the larger domain of saltwater fish, might distinguish between sharks and non-sharks. An even lower level might distinguish between sharks that are edible and inedible. Hierarchical clustering analysis groups objects according to these general and specific relationships between the objects, comparing objects to one another on the basis of the number of times the objects fall into the same closely related or distantly related groups and clustering the objects based on these comparisons.

The information we receive from these two methods first identifies relationships among saltwater species as perceived by recreational fishermen, then determines the characteristics which make saltwater species desirable or undesirable, and finally utilizes this information in a program designed to change fishermen's attitudes toward underutilized species. Discovering the relative position of underutilized species within

a multidimensional scaling's configuration is analogous to the concept of "product positioning" in marketing research.

The concept of product positioning refers to the discovery of the structure of a particular product domain (e.g., different kinds of coffee) and the development and packaging of new or old products or old ones for new markets based on identification of yet unexploited portions of this particular domain. The development of a new popular brand of coffee provides a good example of product positioning. (Stefflre 1972).

One further method is used to identify and understand the attributes or dimensions of the domain of fish species. This method is complementary to the scaling procedure and involves the construction of sentence frames (belief-frames) that aid in the identification of important attributes. These sentence-frames, or belief-frames, are used in conjunction with the multidimensional scaling output to develop a model of recreational fishermen's beliefs about the fish they seek and ignore (D'Andrade et al. 1972).

Construction of the belief-frames are based on interviews with recreational fishermen from each study area. The way fishermen describe the properties and attributes of traditional and non-traditional recreational species (e.g., fighting characteristics, eating characteristics, etc.) were used to construct these frames. Recurrent properties in fishermen's descriptions were incorporated into a series of sentences. Subjects were asked to provide the species (from an appropriate list) associated with the attribute implied in each sentence, such as "You can not eat _____ because it has worms."

These species/belief-frame comparisons were incorporated into an "item-by-use" matrix (Stefflre 1972) organized in a species-by-attribute form. A method for clustering rows and columns that were similar was used to discover species with similarities. This method compares to one used in the study of food snacks and their attributes with respect to when they are eaten (Stefflre 1972).

The species-belief frame matrix was sorted by rows and columns so that rows that were similar to one another were near one another and columns that were similar to one another were near one another. This was accomplished through a combination of techniques used by both D'Andrade, et al. (1972) and Stefflre (1972). D'Andrade, et al. (1972) computed Pearson correlation coefficients on similarities between items across belief-frames and between belief-frames across items. These coefficients represented similarity measures and were clustered for rows and columns through the use of a hierarchical clustering scheme (Johnson 1967).

Stefflre (1972), on the other hand, produced a similarity measure based on row-row and column-column similarity in patterning. For our purposes we use a computationally equivalent algorithm that alleviates transposing row and column vectors:

$$Sij = \frac{2(r_i * r_j)}{(r_i * r_i + r_j * r_j)} , \quad \frac{2(c_i * c_j)}{(c_i * c_i + c_j * c_j)}$$

(where equations is based on the dot product(*)). These similarities were then used in an iterative process based on "linear equivalence chains" to sort rows and columns on the basis of similarity (Stefflre 1971).

For our purposes, row-row and column-column similarities were derived by using the computationally equivalent version of Stefflre's algorithm. These similarity measures for rows and columns were subjected to HCL to obtain the sorted species/belief frame matrices for each region.

Sample Size

Given a basic understanding of the techniques and procedures we will employ, it is important to discuss sample size and selection of informants random and non-random. Table 2 shows the sample size and selection process (where stated) of a number of studies employing MDS.

Table 2

Sample Size and Procedures for Several Studies Employing MDS Techniques

Study	Sample Size	Subject Selection
1. D'Andrade et al.	10, 5, 11	---
2. Burton	54	advertisements in school newspaper
3. Wexler & Romney	155, 35, 35	---
4. Rapaport & Fillenbaum	17, 17, 26	---
5. Cliff	31	---
6. Green & Carmone	12	random selection from a field of 22
7. Stefflre	50, 34, 50, 600	---
8. Wish et al.	6 groups of 10-20	recruited by means of posters placed in the International House and Foreign Student Center at Columbia University.

As is evident from this table, most researchers interviewed between 10 and 50 subjects. However, one researcher surveyed as few as five subjects, while another used as many as 600 in a national survey. As Stefflre remarks: "This kind of data stabilizes with fairly small samples of respondents (N=30-60)(1972;214)". It is important to note that these techniques are not as reliant upon sample size for gaining statistical significance as other statistical procedures, such as linear regression or other univariate or multivariate procedures. Rather, it is more important in these procedures to sample subjects who share an understanding of the domain under study. In this study, we are confident that our sample populations represent the shared understandings of most marine recreational fishermen.

THE SAMPLES

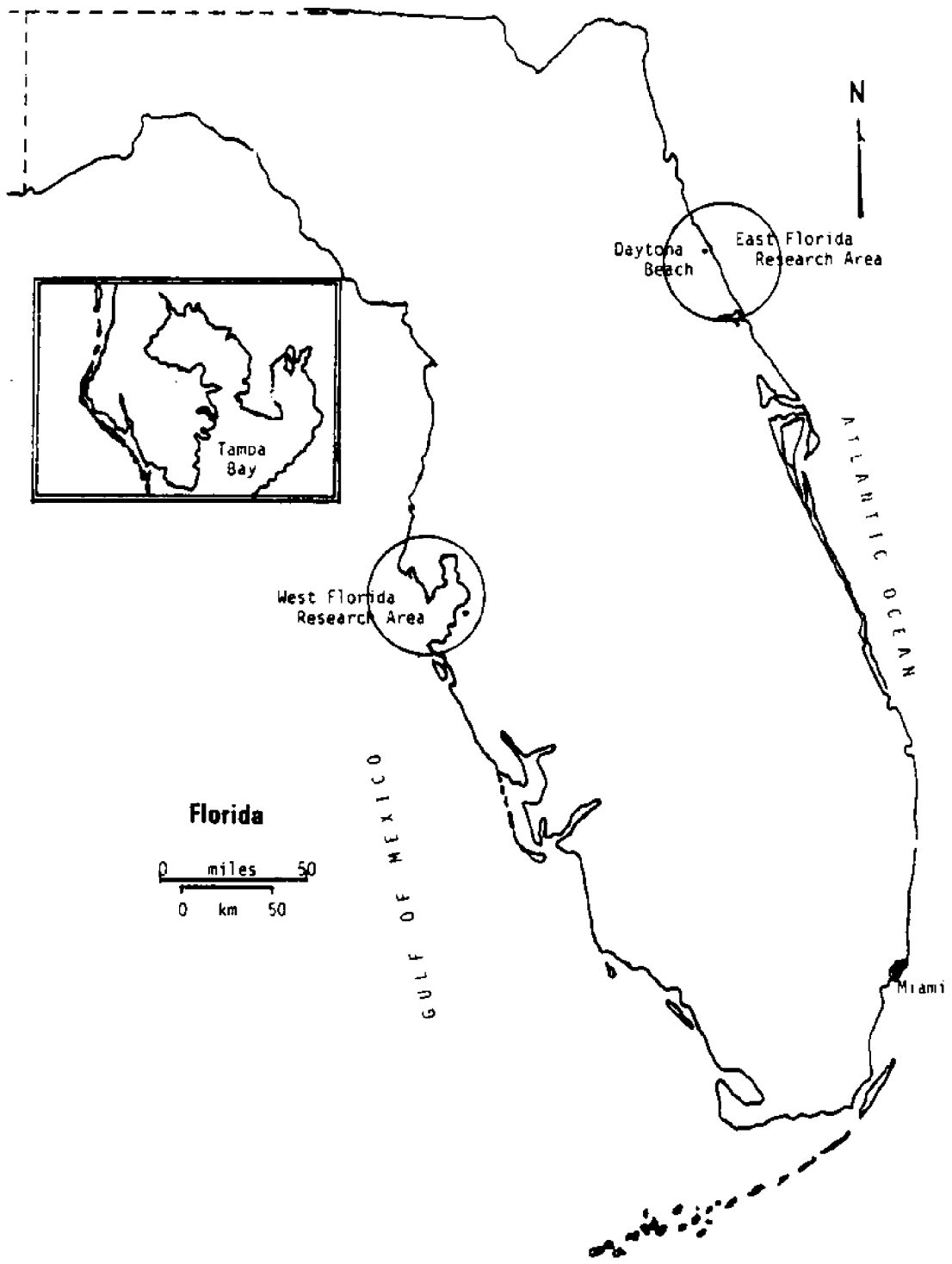
We used five distinct sampling universes to collect data for this research. For the most part, fishermen in this study belonged to non-species-specific fishing clubs. These clubs were located in and drew their members from East Florida, West Florida, Texas, and North Carolina (see maps 1-2). A fifth sample of non-fishing club members was taken from piers and other fishing spots in East Florida for comparative purposes. Some selected characteristics of the fishing club members and their fishing and fish preparation behaviors are included in Table 3.

Selection of Subjects

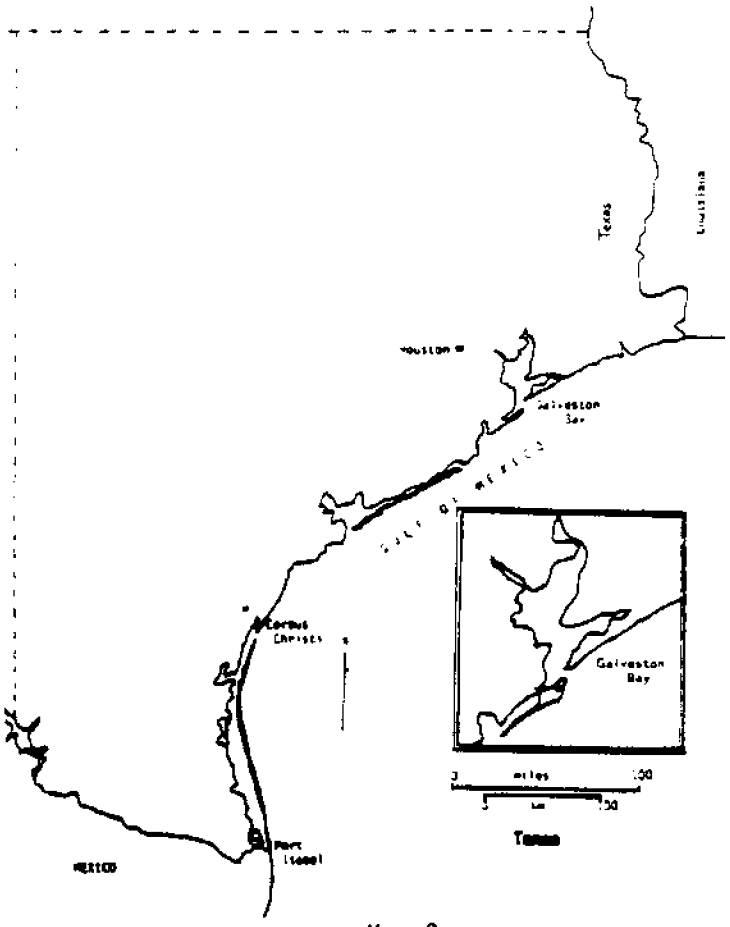
The selection of informants is by far the most pressing issue that need be discussed. Clearly, we would like to interview subjects that are representative of recreational fishermen. Fishermen with different sociodemographic characteristics may or may not display different patterns of fishing behavior. Sociodemographic portraits of recreational fishermen have found that recreational fishermen are limited only by the cost of the fishing trip. Once income is controlled for, the predictive value of other sociodemographic variables in understanding fishermen's choices may or may not be significant. For our purposes, sociodemographic characteristics of recreational fishermen have less importance than informants' shared knowledge about the fish species in their geographical region.

It is instructive to discuss two concepts. One comes from anthropology and the other from consumer research. Anthropologists have based the majority of their research on the premise that members of human societies share beliefs and ways of behaving. These shared understandings and actions are what constitute "culture". Culture is an important concept for our purposes and this importance is evident from the following statements by Burton (1972: 57).

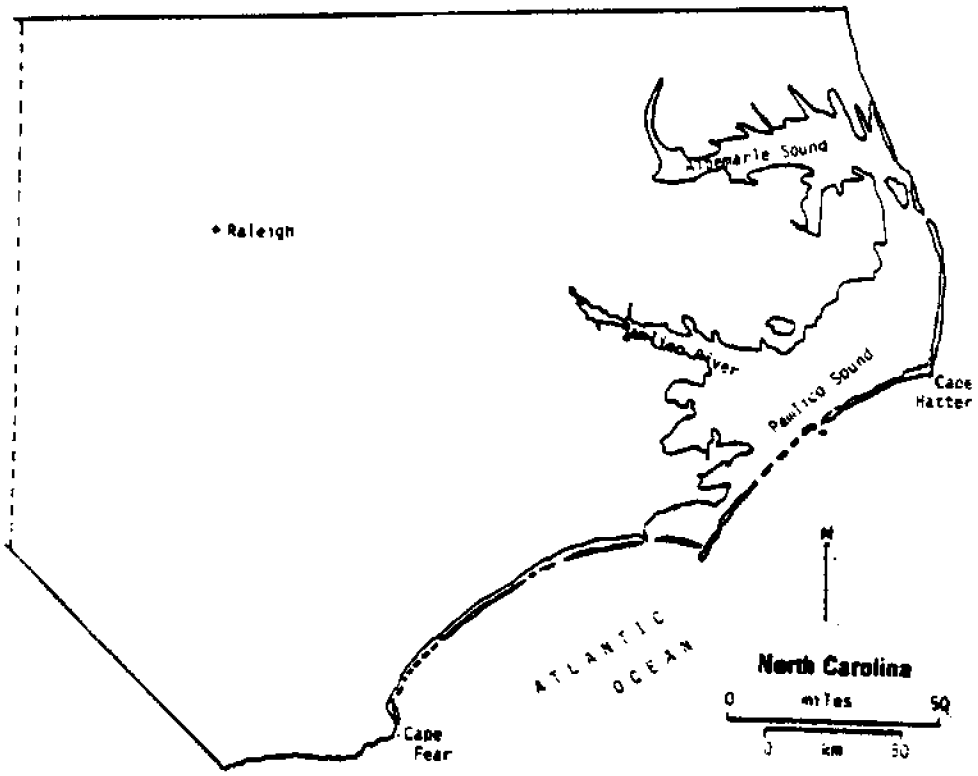
Every cultural system has named attribute scales on which the objects, persons, places, and events of everyday situations are categorized or rated. A productive schema for the description of social behavior in its normative facet is the measurement of these attributes and their



Map 1
East and West Florida Research Areas



Map 2
Texas and North Carolina Coastal Areas



Selected Characteristics of Fishing Club Members

Variable	East Florida				West Florida				North Carolina				Texas			
	Mean	Median	Mode	Percent	Mean	Median	Mode	Percent	Mean	Median	Mode	Percent	Mean	Median	Mode	Percent
Length of club membership, in years	6.87	7.5	10		5.13	4.12	3		2.3	2	1		1.7	3.3	3	
Age of participants	49.6	44.4	44		48.7	52	52		42.3	39	28		41.2	40	36	
Education of participants, in years	15.6	15	16		14.3	14.2	16		17.3	16.4	16		17	16.2	16	
--% without high school diploma				4.2				0				0				5
--% with only high school diploma				20.8				26.1				6.9				0
--% with HS degree but less than 4 years of college				29.1				34.7				6.9				5
--% with 4 years of college				25.0				30.4				37.9				55
--% with advanced degrees				20.9				8.7				48.3				35
Percent who own their own boats				91.7				56.5				60				70
Percent who clean, scale, etc. fish themselves				96.0				100				93.3				90
--0-20% of time				4.0				0				0				0
--21-50% of time				12.0				4.3				1.3				0
--51-99% of time				8.0				0				0				10
--100% of time				72.0				95.7				90.0				80
Percent who have someone else clean, scale, etc. their fish				28.0				4.3				6.6				20
--0-20% of time				8.0				0				0				10
--21-50% of time				16.0				0				3.3				0
--51-99% of time				4.0				4.3				0				0
--100% of time				0				0				3.3				10
Percent who cook their own fish				72.0				78.3				86.7				55
--0-20% of time				8.0				17.3				9.9				5
--21-50% of time				12.0				17.3				20.0				10
--51-99% of time				16.0				12.9				19.8				5
--100% of time				36.0				30.4				36.7				35
Percent who have another person cook their fish				60.0				21.9				63.3				65
--0-20% of time				8.0				8.7				13.2				5
--21-50% of time				8.0				26.1				26.6				10
--51-99% of time				20.0				26.1				13.2				5
--100% of time				24.0				13.0				10.0				45
Cooking styles: percent of population who																
--Broil				59.1				78.3				73.3				55
--Deep Fry				59.1				65.2				73.3				65
--Pan Fry				22.7				34.8				16.7				5
--Bake				31.8				39.1				40.0				30
--Barbeque/Grill				22.7				30.4				36.7				15
--Smoke				31.8				26.1				10.0				5
--Other				4.5				4.3				3.1				5

*Additional characteristics, comparing fishing club members with a national sample of fishermen, are presented in table 6 below.

Table 3
Selected Characteristics of Fishing Club Members

relationships both to the semantic system and to behavioral norms. The measurement of objects on such scales is an important part of cultural description.

We will think of culture as shared ways of thinking and believing transmitted from individual to individual through socialization. Like Burton, we are interested in a cultural description of sorts. However, our interests lie in describing the social behavior of recreational fishermen that may be directly attributable to the manner in which fishermen categorize or rate the fish they seek or avoid.

All beliefs and perceptions used in the categorization of named attribute scales will be affected by the degree to which subjects have been socialized into a particular system. In other words, an 11-year- old's understanding of his or her kinship system is less than his or her 30-year-old father's. We assume distinct parameters defining the nature and extent of knowledge about a particular domain. This knowledge is shared among all members of the system and is passed to new members through socialization. In this case, an individual that is new to recreational fishing generally will be socialized as a recreational fisherman through his or her experiences and subsequent discussions with more integrated members of the recreational subculture (e.g., at parties, bars, at home, on boats, on piers, etc.).

Consumer research concepts provide further clarity. Consumer behavior researchers are interested in identifying market segments. Green and Carmone (1972) define market segmentation as:

> ...a reasonably homogeneous group of buyers who respond differently from other segments to similar marketing appeals-advertising, point-of-purchase display, product features, and so on. That is, emphasis is placed on individual differences in sales response to more or less the same stimuli (185).

Unlike product domains, the domains of fish and fish attributes receive little the influence from advertising, point-of-purchase display, and so on. (However, we are interested in homogeneity with respect to a normative understanding of a particular semantic domain.) While the types of stimuli described by Green and Carmone may have some influence on the behavior of recreational fishermen, the greatest influence is that recreational fishermen have upon one another. For our purposes, therefore, we approach the problem from a cultural rather than a market segmentation perspective.

This does not mean that the population of U.S. marine recreational fishermen is homogeneous, consisting of a single language or ethnic group whose attitudes toward fish are uniform. In fact, our findings may not apply to segments of the total recreational fishing population. It could be argued that because the fishermen in our sample are overwhelmingly white males, drawn from fishing clubs, our findings cannot be extended to black, Hispanic, Korean, Vietnamese, or other minority recreational fishermen in the United States. The basis for this argument lies in the findings of linguists and other social scientists. They argue that distinct

differences in linguistic behavior, socialization, and ethnicity between whites and other ethnic groups result in different meanings, perceptions, and beliefs. However, Romney (1979) has shown recently that ethnic enclaves in the United States may show more in common cognitively with the mainstream of American culture than is evident from casual observation. This points to the importance of the length of exposure to American popular culture(e.g., television, radio, etc.) and interaction with other social groups in the United States.

Although our findings may not apply to ethnic groups other than white, U.S.-born individuals, this does not necessarily undermine the importance of our findings or their effectiveness as tools to increase the utilization of underutilized species. Two factors support this. First, studies of marine recreational fishermen that have used random sampling techniques show that the majority of marine recreational fishermen in the U.S. are white (KCA Research 1983). As the following table shows, non-white ethnic groups comprise about 5 percent of the Atlantic marine recreational fishermen and no more than 15 percent of the Gulf and Pacific recreational fishermen:

Table 4

Percentage Distribution of Marine Fishing Households By Race

Racial Category	Atlantic	Gulf	Pacific
White	94.9	85.8	89.3
Black	3.4	7.6	2.3
Hispanic	0.7	5.1	4.7
Indian	0.3	1.3	1.2
Oriental	0.2	0.2	1.6
Other	0.5	0.0	0.5
SE Asian	0.0	0.0	0.4

Source: KCA Research 1983, p. 5.

Second, is the underutilization of species a problem among non-white ethnic groups? Despite a lack of conclusive evidence, it is widely believed that non-white fishermen utilize a broader range of fish than white fishermen. For example, investigators were told that Koreans in Daytona routinely came to the piers to buy ribbonfish from fishermen for soup. White fishermen in Daytona, however, tended to reject ribbonfish as being too small. In addition, many fishermen said that blacks would be the best individuals to consult about cooking and cleaning certain underutilized species. Talking about blowfish one respondent said, "Blacks are more knowledgeable about eating them. They know how to clean them. They're poison if you don't know what you're doing." Certainly some comments stem from stereotypes members of one ethnic group have about another. But frequency of such comments during the interviews lends some support to their validity.

Fishing Club Members and Non-Members: A Comparison

In addition to the question of ethnicity, it is important that club samples be representative in terms of the perceptions toward and use of saltwater species, as well as in terms of variables such as income, resource use, and so on. Therefore, the question arises: How much do club and non-club fishermen differ in their perceptions of fish? Two methods were used to investigate this question. The first compares judged-similarity data collected from a sample of 10 non-club fishermen in Daytona Beach and 10 randomly selected fishing club members from the same area. The second method compares interpretability of the multidimensional scaling output for two dimensions. The final comparison consisted of correlations between input matrices for the groups. Table 4 presents both the Pearson and Spearman correlation coefficients derived from the comparison[4]. As is evident from Table 5, the input data is significantly similar to conclude that a high degree of agreement existed between the two samples.

Table 5

Correlation Between East Florida Club and East Florida Non-Club Input Data

Pearson	Spearman
.78	.63
0.0001	0.0001

Further support for this was provided by a comparison of multidimensional scaling outputs. Visual interpretation of dimensions one and two for the non-club and club scaling reveal similar edibility and sport dimensions. Differences surfaced, not in dimensions, but in the relative placement of fish within the two-dimensional plots. Some fish in the edibility cluster for the non-club scaling were not in the edibility cluster for the club scaling. These varying placements help account for the slight differences encountered in the comparison of the input matrices.

Although these findings show no significant differences between club and non-club members, they reveal possible differences in perceptions about some particular species. These differences probably occur because the two groups tend to fish from different locations, with varying experiences with certain species. Club members overwhelmingly fish from boats, while the non-club sample fish almost exclusively from piers or head boats. These differences in orientation and species contact would naturally influence particular beliefs about species.

In addition to these comparisons, we compared our sample populations with a randomly selected population of marine recreational fishermen. Table 6 presents these comparisons.

Qualitative information suggests that similarity exists between our sample and the majority of marine recreational fishermen in regards to other aspects of fishing. In a recent comprehensive study (KCA Research), the most frequently cited reasons for fishing included the sporting dimension of catching fish, and fishing as a form of relaxation or leisure (cf. Johnson, et al., in preparation). Although our study did not specifically address motives for fishing, fishermen volunteered this information during the course of the interviews. As an indication of the desire to fish primarily for sporting purposes, some anglers reported that they fished either exclusively or primarily with artificial baits because using these bait were more challenging than dead or live baits. "Anybody can catch fish using cut bait," said one. "The true sport fisherman fishes with lures." This attitude is also reflected when fishermen classify fish into sportfish categories or differentiate between species by the way they were caught (e.g., with aritificial lures, by trolling, etc.).

Table 6

Comparisons Between KCA Study and Fishermen in the Four Target Areas

Variable	KCA Study Atlantic	KCA Study Gulf	E.Florida	W.Florida	Texas	N.Carolina
Mean number of fishing trips/year	23.5	25.9	40	81.5	22	15
Mode number of fishing trips/year	---	---	50	30	15	8
Median number of fishing trips/year	---	---	98.5	40.5	19.8	11.5
Percent of population[1] who fish from a private boat:	38.6	38.4	92	82.6	95.2	73.3
01-49% of time	--	--	0	15.8	28.7	23.3
50-99% of time	--	--	44	21.1	23.6	33.3
100% of time	--	--	48	63.2	42.9	16.7
Percent of population who fish from the beach or bank:	18.4	19.3	40	21.7	52.4	76.7
01-49% of time	--	--	40	8.6	19.1	43.3
50-99% of time	--	--	0	8.6	33.5	33.4
100% of time	--	--	0	4.3	0	0
Percent of population who fish from a structure:	26	27.7	24	30.4	9.5	50
01-49% of time	--	--	24	8.7	9.5	40
50-99% of time	--	--	0	16.9	0	10
100% of time	--	--	0	8.7	0	0
Percent of population who fish from a charter boat:	17	14.6	8	8.6	14.3	30
01-49% of time	--	--	4	8.6	9.5	23.4
50-99% of time	--	--	4	0	0	6.6
100% of time	--	--	0	0	4.8	0
Annual Income:[2]						
0-25,000	56.9	62.1	40	34.8	--	20.7
25-35,000 (40)	23.3	20.3	33.3	17.4	11.8	37.9
35 + (40+)	19.8	17.6	26.7	30.4	88.2	41.4

(Table 6 -- Continued)

Notes:
1. KCA Study does not have information on the percent of time devoted to particular fishing modes.
2. KCA Study's categories for income were 0-25,000; 25-35,000; 35 and over. Our income categories were 0-25,000; 25-40,000; 40+.

The perception of recreational fishing as a form of relaxation also emerged during discussions with fishermen. One respondent equated recreational fishing with golf, stating that one could be substituted for the other when the goal was relaxation and enjoyment. Another called himself a "comfortable fisherman," adding that he did not enjoy fishing that involved too much work or discomfort, such as fishing all night on high seas, where he was likely to be cold and seasick. Others said that, because they fished primarily for sport and relaxation, they released most of the fish they caught.

In addition to sharing motives for fishing, anglers in our sample also shared behavioral traits with the general population of marine recreational fishermen. The KCA study found that almost every fisherman sampled targeted specific species or types of species. However, fishermen in our sample rarely targeted a single species. Instead, they tended to list species they would prefer to catch. Often they indicated this preference by repeatedly visiting specific habitat where they were likely to catch a specific species using similar techniques and tackle rigs. Consequently, many fishermen classify fish on the basis of species habitat or characteristics (e.g., deepwater reef fish, surface feeders, etc.). Many fishermen also grouped fish according to fishing techniques, saying things like "These fish you catch by trolling," or "You don't have to change anything to fish for them."

In combination, the similarities between our sample of marine recreational fishermen and from studies with larger sampling populations attest to the relevance of our findings to the majority of recreational fishermen.

ANALYSIS AND RESULTS

This section is cumulative in nature. Each region's findings are compared and contrasted with those preceeding it. The cognitive similarity between regions make this strategy of presentation the most sound. A cursory perusal of the quotes that fishermen used to tell why they grouped species together, or a glance at the clusters that emerged from the HCL output (see Table 7), demonstrates that the basic criteria recreational fishermen use to distinguish between species, are found in all regions. Thus, the information regarding the general perceptual means by which fishermen categorize and rate species is presented in the early part of the analysis, in the East and West Florida contexts. Thereafter the space devoted to regions is considerably less. The following table, which we will refer to

throughout the analysis, shows that while the species that fill the categories change, the basic categories remain more or less unchanged from region to region.

East Florida

The East Florida sample was drawn from the 24-mile stretch of coastal communities including Ormand Beach, Holly Hill, Daytona Beach, South Daytona, Port Orange, and Ponce Inlet. Attracting thousands of tourists every year, this area is characterized by motels, condominiums, gift shops, bars, a world famous race track, and other services and attractions catering to the tourist trade.

Resident fishermen consider the area a paradise for recreational fishing. There are estuaries of Mosquito Lagoon to the immediate south and the Halifax River. There are beaches, surf, and piers, the tropical waters to the south and the temperate waters just off shore. Fishermen have access to a broad range of saltwater species. The recreational fishing resources accessible from Daytona greatly enhance the area's attraction for tourists. Motels display a variety of brochures advertising the deep sea fishing vessels leaving daily from Ponce Inlet. The Ormand Beach, Main Street, and Sunglow Ocean piers provide ready access to inshore species at a nominal cost. Marinas located along both banks of the Intracoastal Waterway offer complete support services for the recreational boating traffic. According to resident fishermen, the area's only drawback is its lack of easy access to the open sea. Ponce Inlet, around 12 miles south of Daytona, handles the majority of marine traffic moving between inland waters and the open sea. For Ormand Beach residents, access to the open sea requires a 20-mile cruise. According to fishermen, Matanzas Inlet to the north is too treacherous for all but the most experienced captain.

Despite restricted access to the open sea, resident fishermen maintain that recreational fishing in the area rivals almost any other area on the Atlantic coast.

Characteristics of the East Florida Sample

Thirty members of the Halifax Sport Fishing Club were contacted by phone and subsequently interviewed in person. This club has a membership of around 100 (98 are listed in the 1983-84 roster). Sociodemographic data on the club members interviewed are presented in Tables 3 and 6.

These tables show that almost 100 percent of the East Florida fishermen interviewed clean their own fish. A substantial proportion also cook their fish or oversee the cooking of fish in their households. This was found to be the predominant pattern in the other research areas as well.

The Halifax Sport Fishing Club meets monthly at the Municipal Yacht Basin in Daytona Beach. We attended one meeting early in the data collection period. We were introduced by one of the club's oldest members and briefly

Species Clusters By Major Categories for the Four Regions:
East Florida, West Florida, North Carolina, Texas

Major Category	East Florida	West Florida	North Carolina	Texas
I. Sportfish[1] a) "Poor-eating."	Amberjack Barracuda Tarpon Blue Runner Crevalle Jack Ladyfish Rainbow Runner	Amberjack Barracuda Tarpon Blue Runner Crevalle Jack Ladyfish	Amberjack Barracuda Cobia Little Tuna Dolphin Spanish Mackeral Wahoo King Mackeral Snook* Tarpon Atlantic Mackeral	Amberjack Barracuda Pompano* Snook* Tarpon Cobia Spanish Mackeral Wahoo King Mackeral
b) "Good-eating."	Cobia Dolphin Spanish Mackeral King Mackeral Wahoo	Bluefish Wahoo Cobia Dolphin Pompano Snook* King Mackeral Spanish Mackeral		
II. Meatfish a) off-shore	Black Sea Bass Jewfish Gray Snapper Red Snapper Schoolmaster Snapper Mutton Snapper Black Grouper Nasau Grouper Lane Snapper Red Grouper Warsaw Grouper	Black Sea Bass Nasau Grouper Red Snapper Warsaw Grouper Scamp Lane Snapper Jewfish Red Grouper Black Grouper	Black Sea Bass Red Snapper Warsaw Grouper Nasau Grouper Mutton Snapper Red Porgy Jewfish Gray Snapper Lane Snapper Schoolmaster Snapper Black Grouper	Jewfish Red Snapper Black Grouper Schoolmaster Warsaw Grouper Nasau Grouper Red Grouper Lane Snapper Gray Snapper Mutton Snapper
b) in-shore	Bluefish Snook Southern Kingfish Northern Kingfish Summer Flounder Sand Trout Pompano Striped Bass Red Drum Beach Whiting Spotted Trout Southern Flounder Weakfish	Summer Flounder Mullet Sheepshead Weakfish Sand Trout Beach Whiting Spotted Trout Red Drum Southern Flounder	Bluefish Mullet Striped Bass Weakfish Red Drum Spotted Trout --- Croaker Summer Flounder Pompano Spot Southern Flounder Pigfish Sheepshead White Perch Pinfish Butterfish Silver Perch Southern Kingfish Beach Whiting	Summer Flounder Sand Trout Weakfish Red Drum Southern Flounder Spotted Trout
III. Lower quality or less well-known meat fish.[2] a) off-shore	Sheepshead Tripletail Scamp Gag Queen Triggerfish Gray Triggerfish	Queen Triggerfish Schoolmaster Snapper Tripletail Gray Triggerfish Gag Mutton Snapper Gray Snapper	Spadefish Silver Jenny* Tautog/Blackfish Queen Triggerfish Scamp* Gray Triggerfish Tripletail Gag	NO TEXAS CLUSTERS FIT THESE DESIGNATIONS
b) in-shore[3] ("baitfish")	Croaker White Perch Florida Grunts Pigfish Silver Perch Spot Spadefish Mullet Butterfish Pinfish Silver Jenny	Croaker Norther Kingfish* Silver Perch Southern Puffer Pigfish Spadefish White Perch Spot Butterfish Silver Jenny Pinfish Grunts	Blue Runner Northern Kingfish Crevalle Jack Rainbow Runner* Ladyfish	

Table 7
Species Clusters By Major Categories
for the Four Regions

IV. Trashfish[4]	Sea Catfish Southern Puffer Bighead Sea Robin Smooth Puffer Northern Sea Robin Atlantic Stingray Gafftopsail Catfish	Sea Catfish Norther Sea Robin Gafftopsail Catfish Smooth Puffer Bighead Sea Robin Atlantic Stingray	Sea Catfish Smooth Puffer Northern Sea Robin Gafftopsail Catfish Bighead Sea Robin Atlantic Needlefish Red Hake Southern Puffer Atlantic Stingray	Black Sea Bass Queen Triggerfish Grunts Silver Perch Spot Silver Jenny Smooth Puffer Gag Northern Sea Robin Scamp Pinfish Bighead Sea Robin Southern Puffer Blue Runner Spadefish Ladyfish Pigfish Northern Kingfish Rainbow Runner Gray Triggerfish **** Bluefish Sea Catfish Crevalle Jack Southern Kingfish Mullet Gafftopsail Catfish Croaker Sheepshead Beach Whiting Striped Bass* Tripletail Stingray
V. Sharks/Dogfish[5]	Blacktip Shark (Spinner) Dusky Shark Bull Shark Sandbar Shark Smooth Dogfish	Mako Shark Lemon Shark Great White Shark Sixgill Shark Spiny Dogfish		

*Not well known in this area.
***Break within a cluster.
****Break between clusters.

1. Neither Texas nor North Carolina differentiated between "good-eating" and "poor-eating" game fish.

2. These tend to be smaller, if known, and among the in-shore species are those which are usually classified as baitfish. Also, because these fish are considered lower quality as food fish, the finer distinctions based on range and sporting qualities are not so strong in differentiating species from one another in these clusters. Fishermen's lack of experience with some of these species could cause the lack of finer distinctions as well.

3. Species in this category were generally not well known in North Carolina. The "in-shore" meatfish designation probably does not apply here.

4. Texas "trashfish" species include species which were generally not well-known to Texas fishermen; perhaps a better description of these clusters would be to say that they include those species Texas fishermen do not care very much about, nor know much about, nor care to catch.

5. With the exception of West Florida, which differentiated the dogfish from the sharks, all the HCA results contained a cluster including all the sharks and dogfish.

described the goals of our research. The club meeting was organized and engineered with entertainment and education in mind. The general mood was casual and friendly. Members and their guests devoted much of their time to casual conversation and mingling. When the meeting was called to order, a brief session was devoted to old and new business; a guest speaker followed. The speaker's discussed sheepshead, providing information about tackle rigs, habits of sheepshead, bait and means of catching bait for sheepshead. Throughout the discussion, the speaker elicited support and comments from the audience. Often audience members offered lenghty stories or experiences relevant to the topic.

During the interviews in East Florida, we found many of the members to be familiar with a broad range of information sources relevant to recreational fishing. These included publications from the University of Florida/Institute of Food and Agricultural Sciences extension, Sea Grant, The U.S. Coast Guard and the National Weather Service. In fact, the club regularly provides a forum for the exchange of information among marine recreational fishermen. This information clearly is designed to increase the success and efficiency of recreational fishing. The club's programs include not only species-specific lectures, such as the talk on sheepshead, but also lectures on new fishing technology, methods of record-keeping, the development and locations of artificial reefs and more. The dissemination of information through fishing clubs is enhanced by the publication of newsletters and the club's active participation in local sportfishing tournaments, boat shows, and other recreational fishing activities. Finally, some club members were employed businesses related to recreational fishing, such as headboat captains, marina owners and operators, and boat salesmen and mechanics. These individuals may be important links between the investigators and the general population of marine recreational fishermen.

A second sample from East Florida consisted of 10 non-fishing club anglers found at either the Ormand Beach and Main Street Piers or near Ponce Inlet. These individuals, discussed earlier, were selected to compare their responses in the pile-sort tasks to the responses of club members.

Hierarchical Clustering Analysis

The 29 East Florida fishing club members classified fish into 334 categories. Investigators ask them to group species on the basis of how they perceived fish to be similar. Although the number of piles per fishermen ranged from three to 43, those fishermen with large numbers of piles tended to group fish on the basis of perceived family or genetic relationships. There were five such respondents in the sample, who accounted for 155 of the piles or an average of 31 piles a piece. The remaining 24 fishermen accounted for 179 of the piles or an average of 7.5 piles each. Appendix B shows criteria fishermen used to classify fish.

Although citing a wide variety of criteria (see Appendix C), fishermen in East Florida tended to categorize fish into broad groupings according to edibility, sporting or fighting qualities, and habitat. The criteria can

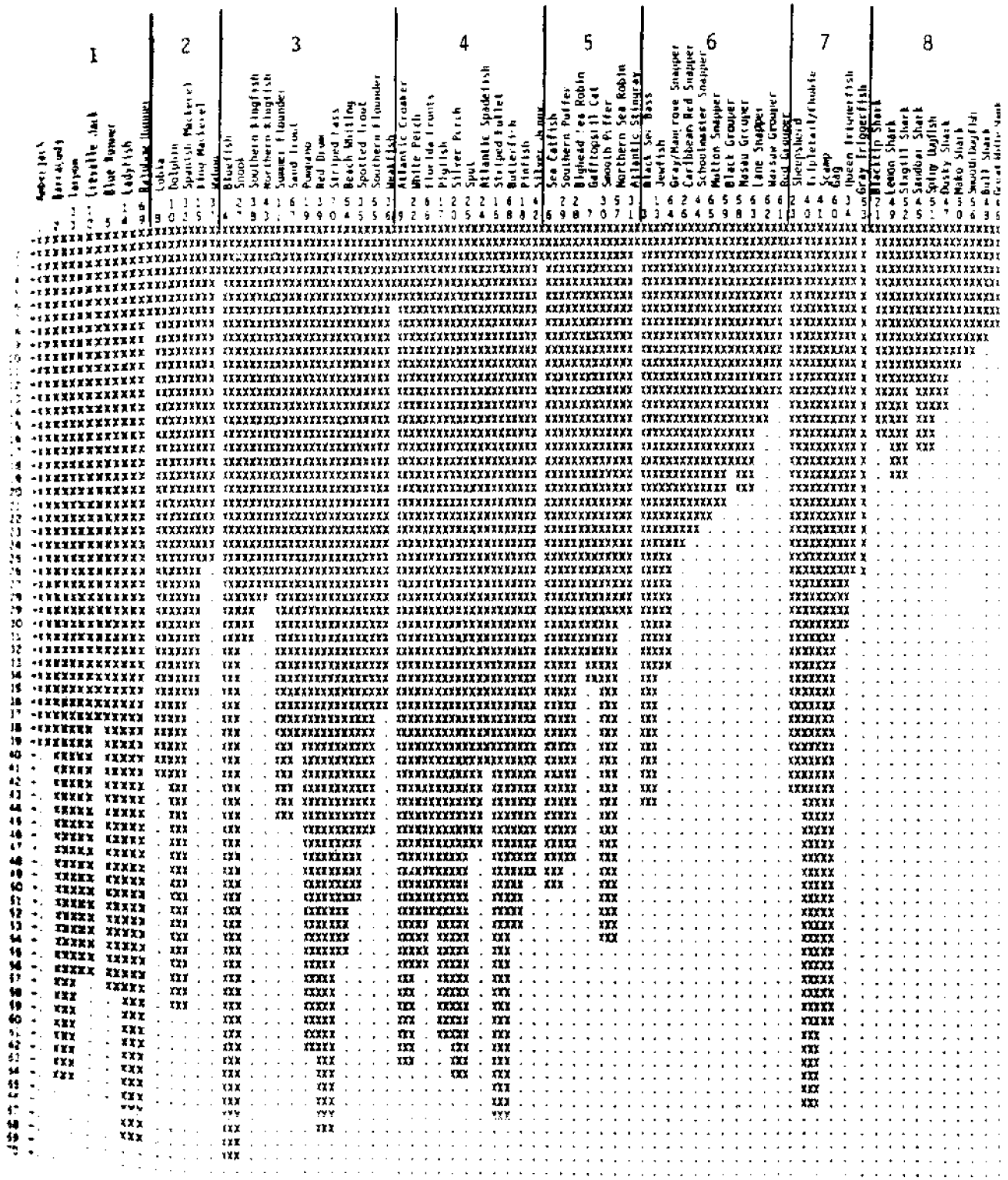


Figure 1
East Florida Hierarchical Clustering Taxonomy

be used to interpret the results of the hierarchical cluster analysis and the three dimensions of the MDS output. The cluster analysis of the East Florida pile sort data revealed the following eight clusters of saltwater species.

Cluster 1

Amberjack	Blue Runner
Tarpon	Rainbow Runner
Crevalle Jack	Barracuda
Ladyfish	

This group consists of fish are considered good to excellent fighting fish, but poor or even inedible food fish. Barracuda were often cited as potential carriers of ciguatera, and there was nearly universal agreement concerning the foulness of the flesh and the boniness of tarpon, ladyfish, and crevalle jack. Amberjack and blue runner were not perceived as food fish, and rainbow runner, a rare fish not well known in this area, fell into this category because of its appearance and name.

The fish in this grouping are caught closer to shore than dolphin or cobia. Consequently, the range or habitat of these species also accounts for the fishermen's association.

The specific criteria fishermen applied to this group include descriptions such as "coastal game fish" or "non-edible sport fish." This group includes species occasionally targeted specifically as tournament fish, such as tarpon. Amberjack and barracuda were also sought for the sport or thrill. Even the small species -- blue runner, rainbow runner, crevalle jack, and ladyfish -- were known to be agressive fighting fish. Some fishermen knew ladyfish by the nickname of "poor man's tarpon."

This cluster can be best described as poor-eating, inshore sport fish. But the way East Florida fishermen perceive family or genetic relationships among saltwater species also accounts for some fish appearing in this category. Many fishermen stated that ladyfish and tarpon were "in the same family." Others grouped the blue and rainbow runners together and the amberjack and crevalle cack together because of the similarity in the names. They said, "These must be related because they're both jacks." Such a grouping is consistent with Rube Allyn's Dictionary of Fishes, a well-known book among Florida fishermen that includes these four species in the crevalle family jacks.

Finally, a few fishermen mentioned the similarity in body shape between amberjack and rainbow runner and between crevalle jack and blue runner. These fishermen also said that a fish's shape often influenced its fighting characteristics. Long and slender-bodied species were seen as better fighters than short, rounded-bodied species.

Cluster 2

Cobia	King Mackerel
Dolphin	Wahoo
Spanish Mackerel	

Most East Florida fishermen rank these fish high on their list of targeted species. All are fighting fish, possessing a medium to excellent food value. Fishermen cited cobia, dolphin, and wahoo, as their most preferred species. "If I could catch these all the time I'd be happy," said one fisherman. "These are the fish I like to catch." The specific criteria that apply to these species are good eating, sport, game, trolling, fighting or exciting fish.

With the exception of Spanish mackerel, these species tend to be caught offshore in the bluer and deeper waters of the Gulf Stream. Not surprisingly, East Florida fishermen perceive them as offshore species. They are associated with fishing from a boat rather than from a pier or beach. Although caught close to shore, Spanish mackerel fell into this category because of its perceived genetic relationship with king mackerel and its name. Because of its edibility, fighting characteristics and name, East Florida fishermen see Spanish mackerel as more similar to offshore (good eating) sport fish than to the coastal, (poor eating) game fish of cluster 1.

Cluster 3

Bluefish	Speckled Trout	Pompano
Snook	Gray Trout	Striped Bass
Southern Kingfish	Sand Trout	Red Drum
Northern Kingfish	Summer Flounder	Beach Whiting
Southern Flounder	Weakfish	

These species are described as "Good table quality pier or surf fish," "Good table quality river fish" or "River, surf or pier fish." A few of these species, such as bluefish, snook and redfish, are considered fair sport fish or challenging to catch. But East Florida fishermen primarily group these species together because they are inshore species (caught from piers, the surf or the river) and all are edible or highly valued food sources. Flounder and pompano received strong acclaim as food fish from East Florida fishermen. Bass, trout, drum and whiting are cited as fair, good or excellent food sources. Also, these species grow large enough to make filleting easy, which increases the fish's food desirability as food fish. On the other hand, with the exceptions of Snook and Bluefish, most of these fish were never discussed specifically as game fish.

Cluster 4

Atlantic Croaker	Spot	Butterfish
White Perch	Pigfish	Silver Jenny
Silver Perch	Pinfish	Florida Grunts
Spot	Atlantic Spadefish	Mullet

These fish were cited by over half of the East Florida fishermen as baitfish. Except for size, the species are nearly identical to those in Cluster 3. The fish are predominantly inshore species, edible, but most fishermen view these species as a means to an end rather than an end in themselves. Fishermen report that they may spend an hour fishing for pinfish, pigfish, grunts and mullet prior to angling for grouper and snapper. Fishermen who had eaten these species said they were good. "After you spend four hours cleaning snapper to get nice big fillets, you're not going to fool with little fish like grunts for a small piece of meat," said one fisherman. In other words, small size was seen as a drawback in food preparation.

Cluster 5

Sea Catfish	Southern Puffer
Gaff Topsail Catfish	Smooth Puffer
Bighead Sea Robin	Atlantic Stingray
Northern Sea Robin	

East Florida fishermen saw these species as the sea's least desirable species. They used derogatory terms - odd-ball species, dangerous, trash fish, pisswinks garbage - to describe these species, which were not targeted for food or sport. A few fishermen had eaten puffer, calling it "The Chicken of the Sea," and an occasional favorable statement was made about gaff topsail catfish. All in all, these fish are considered low on the scale of the ocean's bounty.

Fishermen rejected these species for various reasons. In a few cases, the ugliness of these fish were cited. Others offered explanations that were, at least superficially, more reasonable. Sea robins and puffers were said to be "all head and no meat;" puffers, poisonous; sea catfish, poor tasting scavengers and dangerous to handle because they could use their spines like spears. Fishermen told of bad experiences with catfish and ray stingers and the spines of sea robins. During interviews, investigators were told of lengthy hospital stays, near amputations, recurrent infections, late night visits to emergency rooms, and other horror stories in conjunction with these species. Species in this category offended the fisherman's sense of what a fish should be -- a scaled, silver or colorful fish shaped like a grouper or cobia. But fish in this category have bumps, wings, stingers, blotchy and smooth skins like salamanders, and spines and whiskers like porcupines. They act strange, puffing up, grunting, or flying when tossed in the air.

One of the primary reasons for rejecting these species, then, is that fishermen tend to associate appearances and odd behaviors with undesirable characteristics. The notable exception to this is flounder. With two eyes on one side, often blotchy skin, and a flat body like a skate or ray, the flounder qualifies as unusual-looking fish. In fact, one fisherman told of tossing a flounder back before he learned that from another fisherman what it was. The nearly universal utilization of flounder among marine recreational fishermen suggests that a fish which is good-tasting and easy

to clean will be utilized even if it does not approach the fishermen's ideal.

Cluster 6

Black Sea Bass	Mutton Snapper
Jewfish	Black Grouper
Gray Snapper	Nasau Grouper
Caribbean Red Snapper	Lane Snapper
Schoolmaster Snapper	Red Grouper
Warsaw Grouper	

Like the species in category 2, these are highly prized, targeted species among Daytona fishermen. Fishermen seek these fish primarily to fill their freezers. They are best described as "meat fish." As fighting or trophy fish, they are not extraordinary. Fishermen used these words to describe this group: "offshore, good-eating, bottom fish." Fishermen also said the fish were "stupid," "easy to catch," and "easy to fillet." Their meat was described as snowy white or flaky. No Daytona fisherman reported tossing these fish back unless they were too small to keep.

Cluster 7

Sheepshead	Tripletail
Scamp	Gag
Queen Triggerfish	Gray Triggerfish

These species are considered good eating fish which were caught incidentally while fishing for another species. In other words, these fish were rarely targeted specifically for food, yet many fishermen said that they would keep these fish if they happened to catch them.

They were considered generally difficult to clean. Although triggerfish were known to be very good to excellent eating, many fishermen would not fish for them because their skin was tough. Similar comments were made about sheepshead. Finally, these species were considered challenging species to catch by some fishermen, but others considered them "bait stealers."

Cluster 8

Blacktip Shark	Dusky Shark	Smooth Dogfish
Sandbar Shark	Mako Shark	Spiny Dogfish
Lemon Shark	Bull Shark	
Sixgill Shark	Great White Shark	

This grouping requires little explanation. Obviously, these are all sharks. Almost all fishermen in the Daytona area grouped sharks together, saying things like, "These are just sharks" and "sharks are sharks." In general, most fishermen said they preferred to avoid sharks. "Nobody ever fishes specifically for shark," said one. "You just catch them while you're fishing for something else," said another.

The following table summarizes the above clusters in terms of their desirability as food fish or sport fish, their range or habitat, and other characteristics.

Table 8

Clusters By Edibility, Sport, Range, and Other Characteristics

	Cluster #							
	1	2	3	4	5	6	7	8
Edibility	-	+	+	+	-	+	+	-
Sport	+	+	-	-	-	-	-	+
Range	in	out	in	in	in/out	out	in/out	in/out
Predominantly Other				bait	trash			sharks

Note: For edibility and sport, + means "good" as perceived by fishermen and - means "bad." For Range "in" means inshore and "out" means offshore.

Multidimensional Scaling Analysis (MDS):

In the methodology section we noted two ways to analyze the configurations produced by MDS: 1) examining the proximities or distances between points or 2) looking at the dimensions. Although we will make occasional reference to the proximities, in this section we discuss primarily the dimensions, which can be thought of as continuums reaching from one extreme to another along a horizontal or vertical axis. The stress analysis showed the configuration of points can be understood by examining dimensions one and two. The third dimension does not contain as much information as the other two. Nevertheless, all three dimensions are instructive and will be addressed here. Like the hierarchical clustering analysis, the three criteria which account for similarities among the stimuli are edibility, sport, and to a lesser extent, range.

Dimension 1: The Edibility Dimension. The species in this dimension (along the horizontal axis in Figure 2) are arranged along a continuum from highly desired food fish on the left to poor-tasting or inedible species on the right. At the one extreme we find the flounder, groupers, snappers, and pompano; at the other extreme, shark, dogfish, stingray, puffers, and sea robins.

Interesting and useful relationships among species fall between these two extremes. These internal relations offer clues as to which species to target for increased utilization. For example, although the sharks tend to

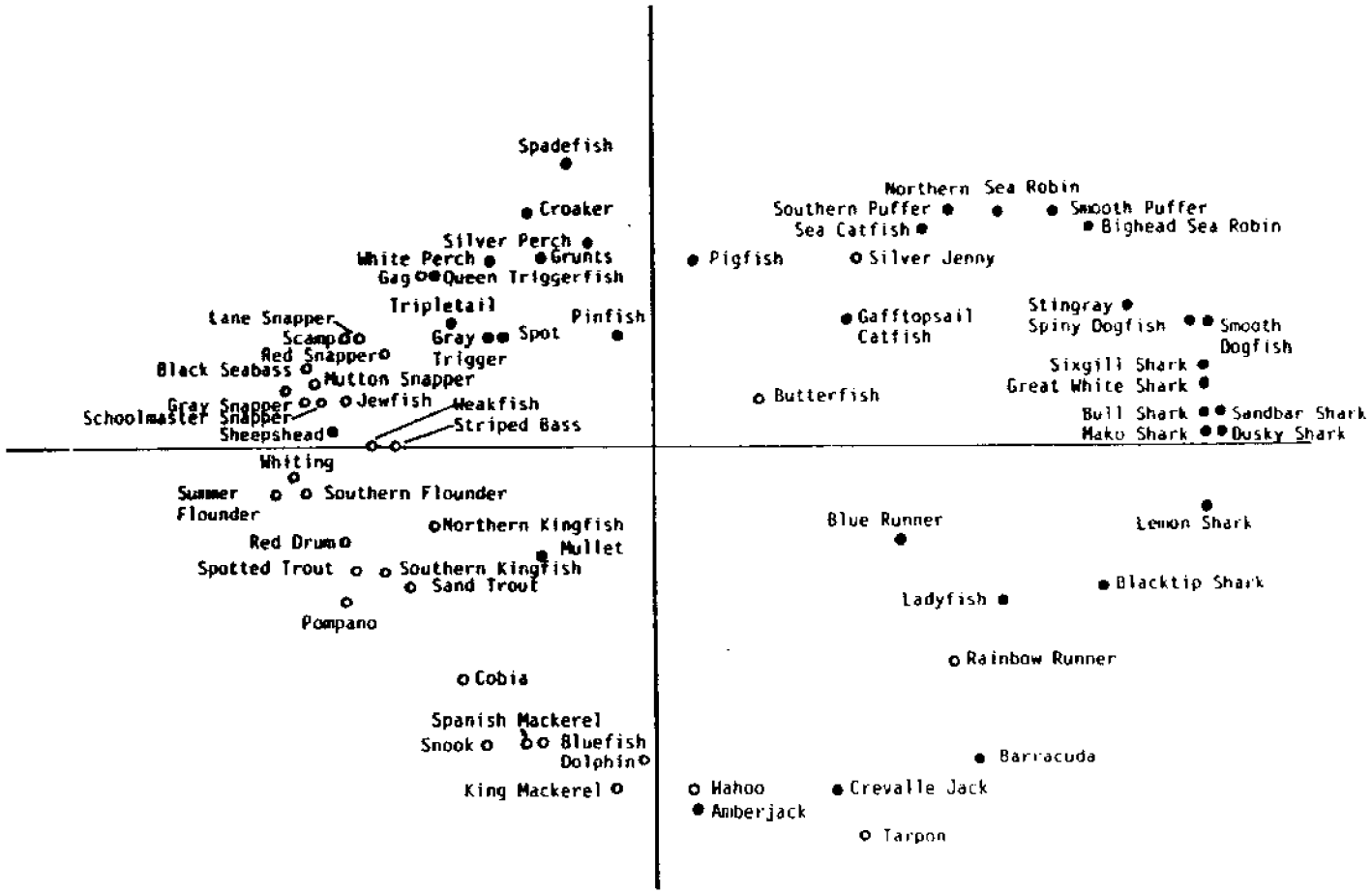


Figure 2
Multidimensional Scaling for East Florida:
Dimension 1 vs. Dimension 2

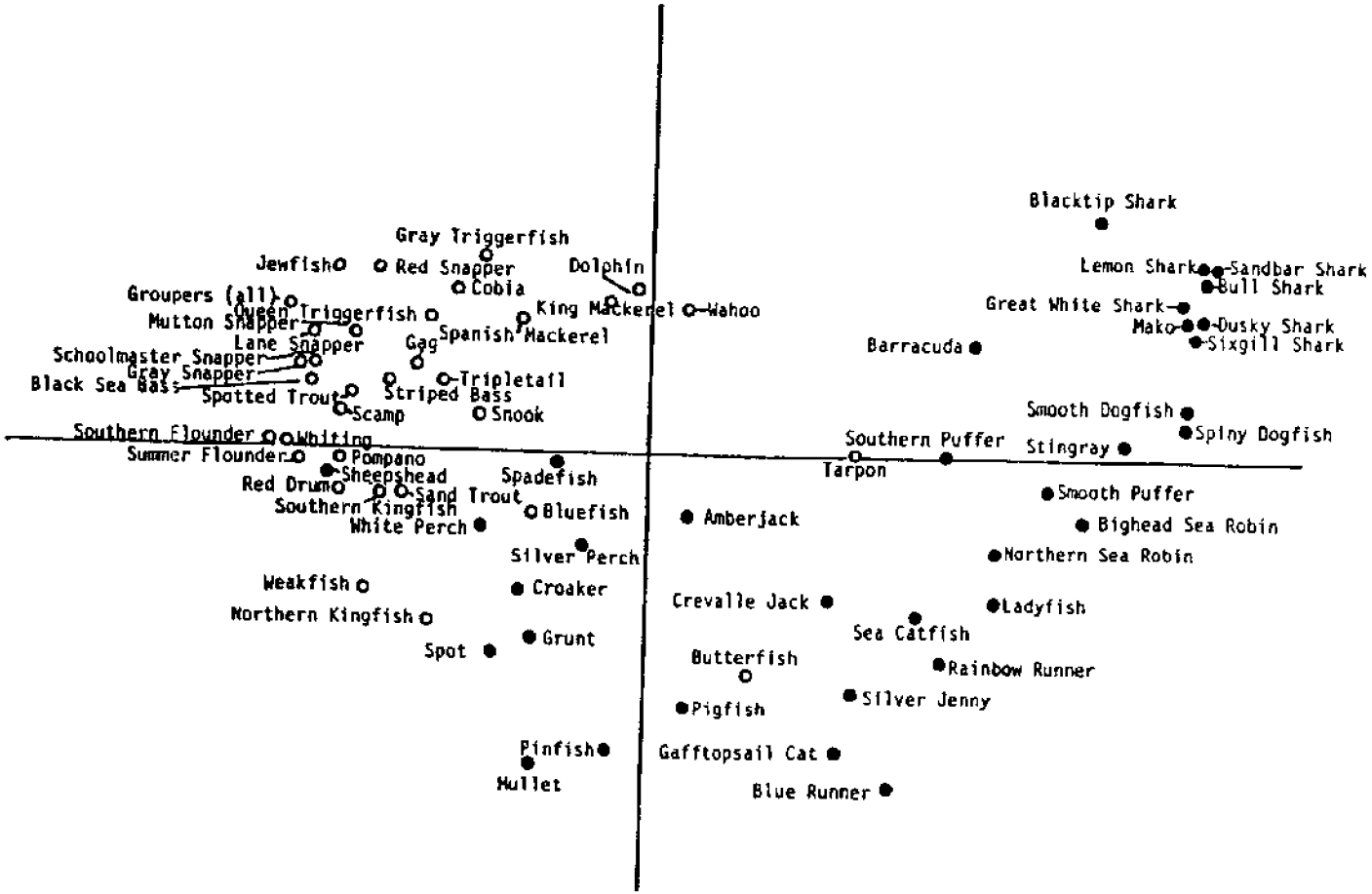


Figure 3
Multidimensional Scaling for East Florida:
Dimension 1 vs. Dimension 3

cluster together, two species of shark - the lemon and blacktip - are further from the others and are being "pulled" toward the desired eating side. This suggests that these species may be the best potential candidates to target for increased utilization. Obviously some East Florida fishermen perceived blacktip and lemon sharks as different and placed them in piles separate from other sharks. The item-by-use matrix (Table 9) shows that blacktip sharks are considered slightly more desirable as sport fish than other sharks, also more desirable as a sport fish.

Another interesting example is the gafftopsail catfish. It is slightly more desirable as a food fish than its cousin, the sea catfish. It is also further from the cluster of trash fish in the upper right corner of the configuration (fish perceived as neither food or sport fish).

These examples demonstrate the usefulness of this information for designing an educational program to increase use of underutilized species. They show us where potential for the improvement of a species' "image" may be possible and how improving the image may be accomplished by pointing out its similarities with desired, utilized species.

Dimension 2: Sport of Fighting Characteristics. The continuum of good game fish to poor game fish (along the vertical axis from bottom to top in Figure 2) is expected among recreational fishermen as a means of differentiating between species. According to the configuration, we can see that tarpon, amberjack, wahoo, dolphin, king mackerel and others fall at the positive end of the continuum. Spadefish, croaker, grunt, and other small fish fall at the negative end. Again, we see that blacktip and lemon sharks are perceived as slightly better game fish than other sharks. And the larger gafftopsail catfish is closer to the sporting end of the continuum than other underutilized species.

Others in this group have potential for increased utilization are amberjack and barracuda. Both are close to the extreme positive end of the continuum designating good sport fish. Amberjack, in particular, is close wahoo, king mackerel and dolphin, which are highly desired species for food and sport among East Florida fishermen. Amberjack's major drawback is that it is associated with worms. And the barracuda is believed to, and often does, carry ciguatera.

Dimension 3: Range or Habitat of the Species. This dimension is not nearly as well defined as the first two dimensions. In Figure 3, most of the species found close to shore, in the river and surf, are located towards the bottom of the configuration, while offshore species are located towards the top. The dimension thus runs along the vertical axis in the configuration. There are a few exceptions, however, such as Spotted trout's similar location along the vertical axis as black sea bass's. Still, this dimension suggests that the places in which species are located influence their perceptions of the species. By extension, fishermen's behavior toward saltwater species may vary with regard to the location of the species. In some ways, fishermen view habitat as an influence over the taste or sporting characteristics of the species.

Item-by-Use: Species Similarities and Differences

The clusters or groups of species resulted from the analysis of the belief-frame data are similar to the clusters resulting from the pile sort tasks. This is not surprising; both data sets came from the same fishermen responding to the same set of stimuli. In the previous discussion of species clusters, we addressed the criteria by which fishermen gave as reasons for grouping fish together. In discussing the belief-frame data, however, we address similarities and differences between species and groups of species on the basis of more specific characteristics. These characteristics are presented along the row in Table 9. They include such things as the texture and taste of the meat, the appearance and size of the species, and storage and handling characteristics. Each of these belief frames was suggested by one or more fishermen during the early phases of research in the four target areas.

As Table 9 shows, the 56 saltwater species were ordered into six major clusters (divided by solid horizontal lines). Two of these major clusters were divided further into four smaller clusters (divided by dotted horizontal lines). In addition, it is evident that clusters A-C are more closely related to one another than they are to the other clusters and that clusters D-F. By the same token, the latter clusters are more closely related to one another than to clusters A to C. These broad distinctions roughly correspond to species that are undesirable (A-C) and species that are desirable fishermen in East Florida (D-F).

The characteristics, associated with all the species in cluster A are those in row 4a. With the exception of amberjack, all received over 50 percent response rates for the belief-frame reading, "Most people don't eat ____." And 40 percent of the fishermen said that amberjack could finish this sentence as well. Between 20 percent and 60 percent of the fishermen, however, had never tried eating these species. With the exceptions of tarpon, these species were seen to be "edible, but usually not eaten because other, better species were available."

Beyond these three characteristics, the relationship between these species begin to break down. Those species in Aa, like those in cluster 1 of the pile-sort data, are perceived to be good gamefish or "hard fighting fish" (row 52). But only the blacktip shark in Ab is considered a gamefish. Aa and Ab also are differentiated from one another because species in Ab, the catfish and sharks, are considered dangerous to handle by between 55 percent and 70 percent of the fishermen. Catfish and sharks also tend to be thought of as scavenger fish (row 58), and catfish are bottom feeders (row 61).

The species in cluster B, like those in cluster A, are low in edibility. They are considered trash fish, sometimes poisonous and ugly. In fact, it is ugliness and perceived toxicity that sets the sea robin, puffer, and sting ray apart from the species in Ab. Beyond these negative characteristics, fishermen did not know much more about the species in cluster B. This could be because they are perceived as dangerous, ugly, and poisonous, and, consequently, tossed back readily. Although Cluster C

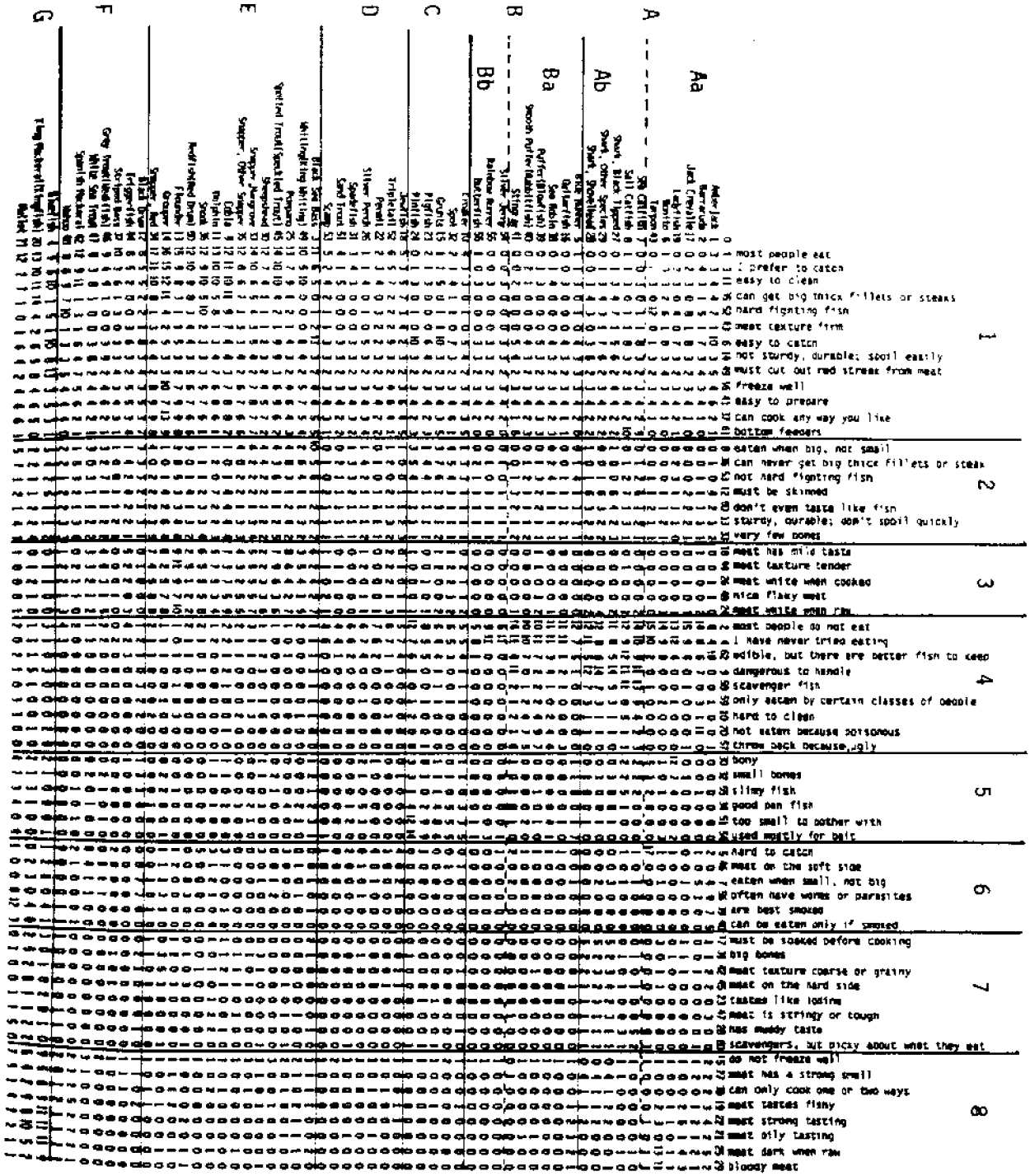


Table 9
East Florida Sorted Item-By-Use Matrix Based on
Row-Row and Column-Column Similarities

species have many characteristics in common with the species in A and B, they have the additional negative characteristic of being small. These species are also different from those in clusters A and B because they are seen as poor gamefish.

While the species in clusters A, B and C constitute desirable species, the species in Ea are those that are most perferred by East Florida fishermen. The species in this cluster, which includes the groupers, snappers, dolphin, cobia, pompano, flounder and others, tend to be associated with good food characteristics and other characteristics that make these species desirable. These species are considered easy to clean, and easy to freeze and prepare. They have mild, tender, white and flaky meats. By contrast the species in clusters A through C tend to be associated with negative meat characteristics (e.g. "meat must be soaked before cooking" and "bloody meat").

For the most part, white, flaky, tender, and mild meat is associated with preferred species and red, dark, and bloody meat with undesirable species. The notable exceptions are the species in cluster F - bluefish, king mackerel and mullet. Over 40 percent of the East Florida fishermen agreed that these species were eaten by most people. King mackerel and bluefish were preferred species for 50 percent and 30 percent of the fishermen, respectively. Yet East Florida fishermen have mixed or contradictory feelings about these species. On the one hand, they share common characteristics with the species in Ea and Eb, such as ease of preparation. On the other hand, they also seen as fish with oily, smelly, fishy, dark and bloody meat that is best smoked.

These findings show that the characteristics of red, dark, bloody meat does not automatically make a fish undesirable. In fact, amberjack and, to a lesser extent, bonito, share many characteristics with bluefish and king mackerel; yet they lie at opposite ends of the column on the table and elicit contrasting responses with regard to questions about use. Most people eat species in cluster F, but most do not eat amberjack and bonito. Amberjack and bonito, however, tend to be viewed as good fighting fish, and their utilization probably could be increased through an educational program pointing out their similarities with the species in cluster F. The similarities between amberjack and king mackerel are especially pronounced, except that amberjack is actually viewed as less dangerous to handle and less bony than king mackerel. The major negative mark against amberjack is its association with worms or parasites.

Nevertheless, the most preferred species are associated with characteristics that reflect upon both saltwater species and the recreational fishing experience. The most preferred species are grouper, cobia, red snapper, spotted trout, mangrove snapper, dolphin, red drum, king mackerel, spanish mackerel, flounder, snook, other snapper, tarpon, and wahoo. With the exception of tarpon, the primary characteristic that unites these species is that they are perceived as easy to handle. Fishermen do not have to go through lengthy steps to catch, clean, store, cook, or eat them. These are species whose associated characteristics explicitly attest to the fact that sport fishing is, indeed, a recreational

enterprise. It is supposed to be a relaxing, enjoyable experience. Evidently, these fishermen do not want to go to extra lengths to catch, clean or cook fish. Consequently, they tend to catch fish which yield big fillets or clean easily. And they shy away from species with meat that needs to be treated prior to eating or with meat that can only be cooked one or two ways.

These comments, however, carry less weight when we consider that recreational anglers fish for the sport as well as for food. This can be seen in the species that are highly preferred and are also seen as "hard fighting fish." They are not as easy to catch as most of the species in cluster E, and those in cluster Aa have little in common with the species in cluster E in terms of food characteristics.

West Florida

The West Florida sample was drawn from the memberships of the Old Salt Fishing Club and the West Coast Anglers. The fishermen interviewed live in the Pinellas County communities reaching from Tarpon Springs in the north to St. Petersburg in the south, including Dundedin, Clearwater, Largo, Seminole, Indian Shores, Redington Beach, and Madiera Beach. Although also catering to the tourist trade, the visible expressions of the tourist industry are less obvious in this area than in the Daytona area. With the exception of tourism development along Gulf Boulevard, these communities appear composed of residential neighborhoods. St. Petersburg is well known as a retirement community, and the surrounding communities suggest similar social, economic, and demographic patterns.

Fishermen in these communities have easy and varied access to the open sea, a number of causeways and bridges to fish from, and a varied fishing environment that includes Tampa Bay and the sheltered waters of Boca Ciega Bay, Lake Seminole, Clearwater Harbor, and the Gulf of Mexico. For fishermen with vessels, the tropical waters of the Florida Keys are accessible for a weekend excursion. Thus, the fishermen in this area have access to nearly as wide a range of fishing opportunities as Daytona fishermen.

Hierarchical Clustering Analysis

As the cluster analysis shows, fishermen on the east and west coasts of Florida perceive and classify species similarly (see Table 7). In particular, the following eight clusters draw upon the broad classification criteria of sporting or fighting characteristics, edibility, and the range of species.

Cluster 1

Amberjack	Crevalle Jack
Barracuda	Blue Runner
Tarpon	Ladyfish

This group, almost identical to East Florida fishermen's cluster 1, is composed of sport fish that are considered, for the most part, inedible. Quotes such as to "fish you catch for fun" and "sport fish, not edible" characterize this group. West Florida respondents specifically cited ladyfish and tarpon as fun fish to catch but poor fish to eat, and similar comments were made about crevalle jack. Blue runner was put in this group because of its similarity in appearance to crevalle jack. Barracuda was again implicated as a ciguatera carrier. Finally, Amberjack again fell into this category of poor-eating sport fish, despite the fact that some fishermen in Tampa/St. Petersburg considered it to be a good eating fish when smoked or prepared fresh the day it was caught.

According to a headboat captain, amberjack was an underutilized species in the area until the mid-1970's. Then inshore waters began to fill with weekend fishermen and divers with small boats, forcing party boat captains

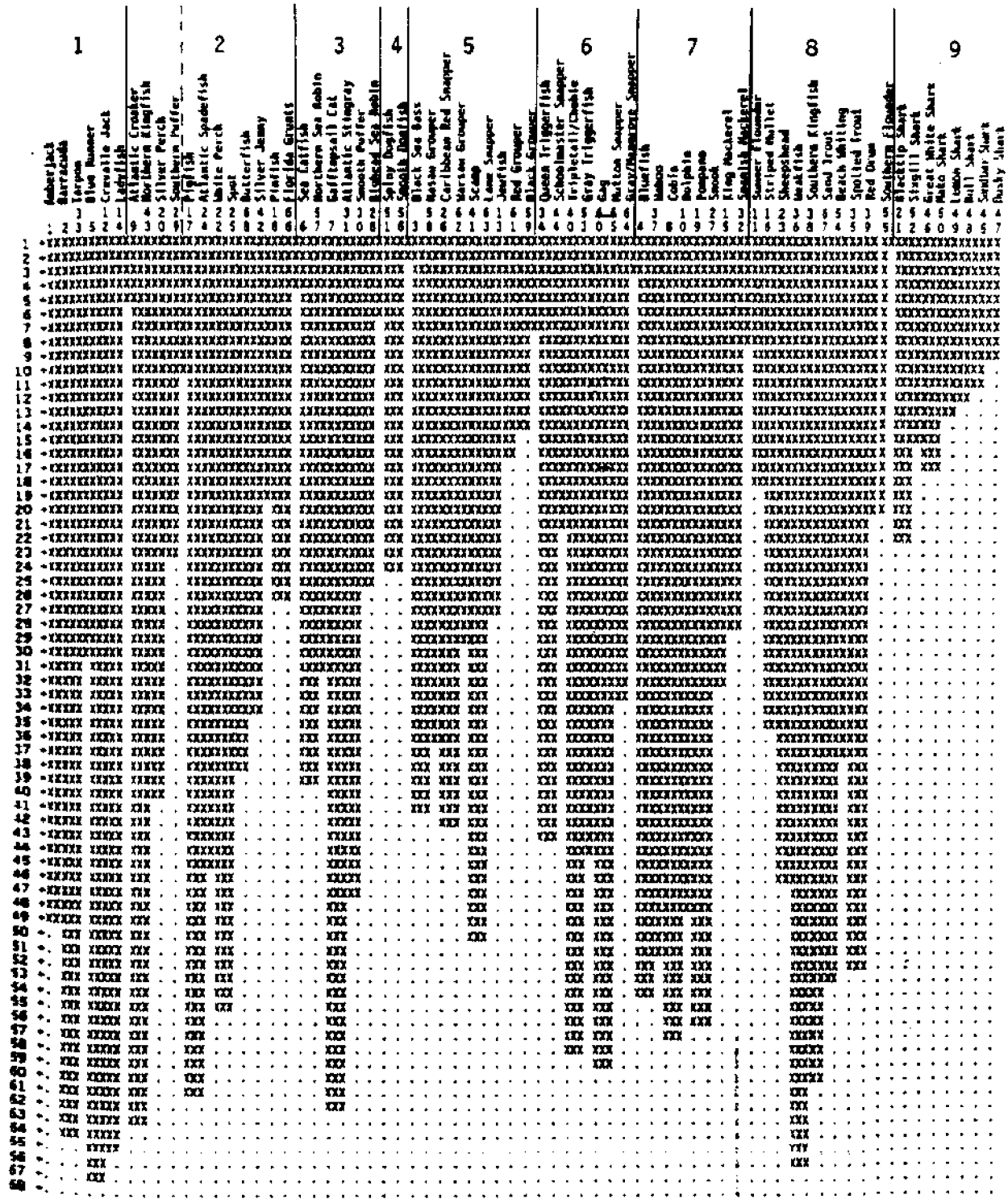


Figure 4
West Florida Hierarchical Clustering Taxonomy

and experienced private boat captains further offshore. Once offshore, they began catching the bigger, harder-fighting amberjack. Tourists appreciated the amberjack because they weren't fishing to fill their freezers as much as to have fun, so headboat captains began actively targeting amberjack. As they caught more of the fish, the captains began experimenting with them as food fish, discovering that the shoulder section of the fish was delicious smoked and cooked fresh. In fact, one captain began selling amberjack to a St. Petersburg restaurant which began to serve it on a seafood platter as a substitute for grouper.

Despite amberjack's acceptance as a targeted species in West Florida, it still falls into the category with those species that are considered good sport fish, but poor food fish.

Cluster 2

Croaker	Butterfish
Northern Kingfish	Silver Jenny
Silver Perch	Pinfish
Pigfish	Grunts
Spot	

These smaller, predominantly inshore species are used as bait but usually are not targeted specifically for food or sport. Other criteria used to label these species were "inshore fish" and "bridge or shallow boat-fishing fish. . ." The overlap between the species in this cluster and those in cluster 4 designated by East Florida fishermen is readily apparent.

Nevertheless, notable differences exist between the two areas. Although the general characteristics defining the cluster are the same for the East and West Florida fishermen, the specific species that comprise the cluster differ slightly. Mullet, which appeared in the bait fish category in East Florida, is viewed as a food fish in West Florida falling into a cluster with flounders, trouts, whiting and other preferred species. And west coast fishermen have included southern puffer in this group rather than in a trash fish category. Although mullet and puffer moved up in quality as food fish among western Floridians, northern kingfish moved down. This probably resulted because many West Florida fishermen had never seen nor heard of northern kingfish.

Cluster 3

Sea Catfish	Smooth Puffer
Northern Sea Robin	Bighead Sea Robin
Gafftopsail Catfish	Atlantic Stingray

Again, these species lie at the bottom of the scale of desirability. The word "nuisance" came up a number of times in conjunction with these species, as well as the more common designations of "trash," "junk" and "garbage."

Cluster 4

Smooth Dogfish
Spiny Dogfish

West Florida fishermen were the only fishermen to differentiate dogfish from sharks. This is because few West Florida fishermen knew much about dogfish and because of the slightly higher value placed on sharks among West Florida fishermen. Many members of the West Coast Anglers also belong to the Tampa Bay Sharkers, a club devoted to catching sharks and participating in shark fishing tournaments.

Cluster 5

Black Sea Bass	Scamp
Nasau Grouper	Lane Snapper
Red Snapper	Jewfish
Warsaw Grouper	Red Grouper
Black Grouper	

These species set the edibility standard. As Table 7 shows, each of the four regions had their highly prized offshore and inshore species targeted specifically for food. Groupers and snappers always comprised the core species of the offshore group. Fishermen describe these species as "edible fish: something most fishermen desire to catch, not particularly because of sport, but for food."

Also, headboat captains like these species because tourists enjoy catching them. One captain said that often he and his colleagues would call grunts "silver snapper" because then tourists would enjoy catching them. Although no one wanted to keep grunts, with the name change he could "pass them off as the catch of the day."

Another attribute commonly cited in reference to these species on both Florida coasts was their marketability. Although the fishermen in our sample were primarily sport fishermen, many also had licenses to sell their catch. Grouper and snapper are easy to sell. Sometimes they are targeted to compensate for the high costs of fuel, tackle, bait and boating associated with recreational fishing. Most fishermen admitted that selling their catch never entirely covered their expenses. Still, it eased their mind about spending so much money pursuing fish, or it appeased their spouse: "You bring home $40 from selling your catch and give it to the wife," said one West Florida fisherman, "and this time you've bought her off."

Cluster 6

Queen Triggerfish	Gag
Schoolmaster Snapper	Mutton Snapper
Tripletail	Gray Snapper
Gray Triggerfish	

These are less well known than the grouper/snapper group above. Like the species in East Florida cluster 7, these fish are second-class in terms of edibility. They tend not to be targeted because they are difficult to catch, difficult to clean, poor fighters, or unfamiliar. With the exception of mangrove snapper, these species are perceived as offshore, bottom fish caught in the same areas as grouper and snapper. Headboat captains usually keep triggerfish and tout them as good-eating fish to their customers, but recreational fishermen with their own boats generally are not too excited toward triggerfish. They might keep then on a slow day, but they prefer the species in cluster 5.

Cluster 7

Bluefish	Pompano
Wahoo	Snook
Cobia	King Mackerel
Dolphin	Spanish Mackerel

These species are described as "good eating sportfish." Snook and bluefish are less known in West Florida than in East Florida. But king mackerel is the most highly prized sport fish in the Gulf of Mexico - an excellent food and fighting fish. According to West Florida fishermen, king mackerel populations have been declining because of overfishing by commercial fishermen. The species in this cluster overlap those in East Florida's cluster 2.

Cluster 8

Summer Flounder	Sand Trout
Mullet	Beach Whiting
Sheepshead	Spotted Trout
Weakfish	Red Drum
Southern Kingfish	Southern Flounder

These are the inshore counterparts of the grouper and snapper species. They are meat fish that offer little excitement as sport fish. The drum and trout can put up a fight, and sheepshead require skill to hook, but the cprincipal characteristic uniting these species in the minds of West Florida fishermen is their edibility.

Mullet and sheepshead were seen as more valuable catches in West Florida than East Florida. Although primarily a bait fish in East Florida, mullet is perceived as an inshore food fish in West Florida. These changes suggest that fishermen's decisions concerning preferred species are due less to experience than to hearsay and socialization of the angler into local fishing. Sheepshead is not, however, unknown as a food fish in East Florida. Its increased utilization seems imminent, given recent articles (Phillips 1984) and topics at sportfishing and club meetings.

Cluster 9

Mako Shark	Dusky Shark
Sand Shark	Lemon Shark
Bull Shark	Blacktipped Shark
Great White Shark	

As noted earlier, only West Florida fishermen differentiated sharks from dogfish. Despite West Florida fishermen's increased familiarity with sharks, the comments still suggest that most anglers would rather avoid sharks than target them.

Multidimensional Scaling Analysis:

The results of the MDS for West Florida show some resemblance to East Florida in terms of edibility, sport, and range. But the species that occupy positions along these continuums differ, and the latter two dimensions are not discernable as they were the East Florida MDS.

Dimension 1: Edibility. This dimension, shown as the horizontal dimension in figure 5, is relatively straightforward and nearly identical to dimension 1 for East Florida fishermen. On the left side of the chart lie the flounders, trouts, groupers, and snappers, and the good eating game fish such as cobin and wahoo. On the right side lie sharks, species perceived as trash fish, and species that are considered inedible such as barracuda and tarpon. Amberjack's ambiguous position reflects its status as an edible fish to some fishermen and an inedible fish to others. Its position in relation to other species, however, did not improve from east to west. However, those species amberjack was near in East Florida MDS, such as king mackerel and wahoo, are here further to the good eating side of the chart.

Other species that warrant attention are southern puffer and mullet. Although near spadefish, grunts and other small species in the East Florida MDS, mullet is here near the groupers and snappers. Southern puffer's improved position relative to other species is the most radical, swinging to the left so far that it nearly crosses the vertical axis to the snapper/grouper side.

Although some species improved in position relative to other species, others suffered. The two catfish lost any desirability they had in East Florida. Among West Florida fishermen catfish fell among the core group of "garbage fish" - rays, dogfish and sea robins. Blacktip shark was not perceived by West Florida fishermen as being different from other sharks, and all sharks fall at the low end of the edibility continuum.

Dimension 2: Size, Shape and Sport or Fighting Characteristics. Figure 6 shows that, moving from the chart's bottom to its top along a vertical axis, the species get progressively smaller and less exciting as sport fish. Again, distinct differences exists between the East Florida and West Florida fishermen's perceptions. Most notably, the sharks are now further toward the bottom of the chart than in the East Florida chart

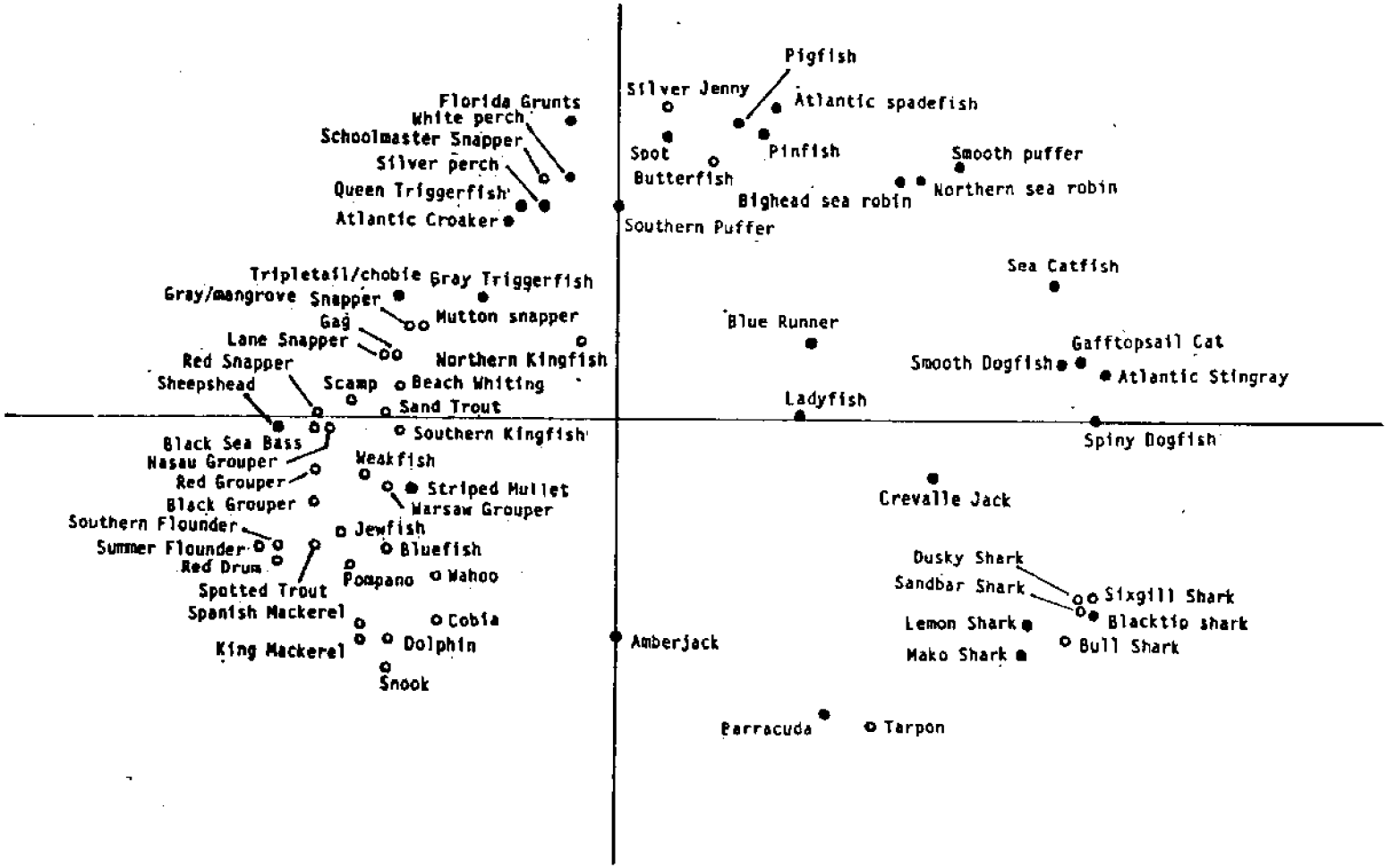


Figure 5:
Multidimensional Scaling for West Florida:
Dimension 1 vs. Dimension 2

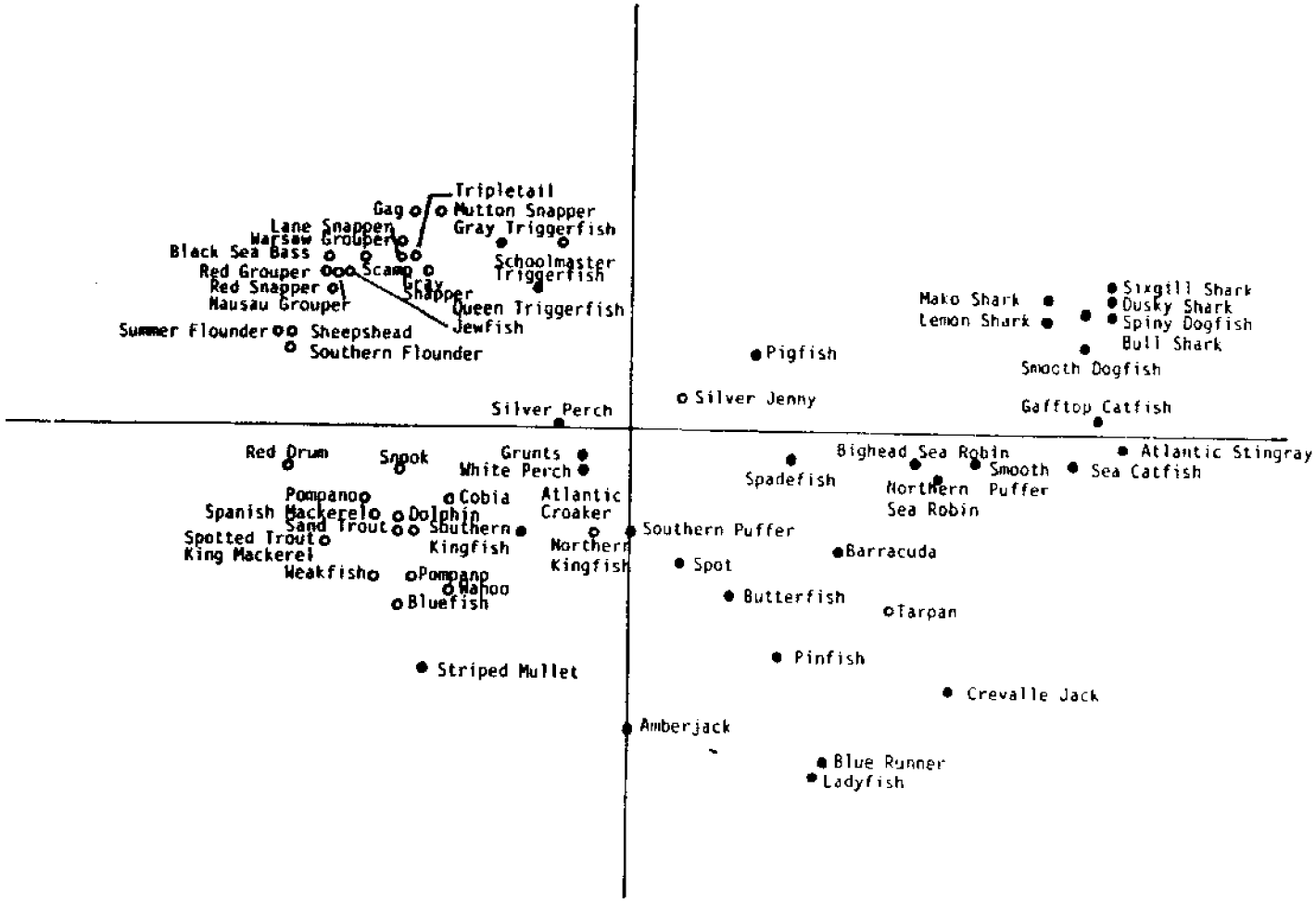


Figure 6:
Multidimensional Scaling for West Florida:
Dimension 1 vs. Dimension 3

(Figure 2). They fall at the same level as king mackerel, wahoo, amberjack, cobia and other hard-striking fish.

The continuum from hard fighting fish to smaller, unexciting species is not nearly as apparent here as in Figure 2. Instead, this continuum incorporates more cognitive information about species, in particular the size and shape of the species (see comments in Table 11, G6). If the axis is rotated counterclockwise about 20 degrees, the vertical axis runs from grunts at the upper extreme to tarpons/sharks at the lower extreme. Then one can discern a progression from longer, sleeker, larger-bodied species associated with sport fish to the shorter, squatter, smaller-bodied species associated with bait fish, puffers, sea robins and other species that are not hard fighters. Rotating the axis does not undermine the interpretation of dimension 1 because the choice meat fish still fall in the left quadrants.

Dimension 3: Range. Once again, the third dimension does not contain much additional information and is not as defined as the other dimensions. Nonetheless, Figure 7 shows that the species in the extreme upper left quadrant tend to be offshore species and bottom-feeders. those species at the chart's bottom tend to be surface-feeding, inshore species. The progression from top to bottom does not move strictly from offshore to inshore species, as one can see by the positions of flounders relative to, for instance, dolphin. However, flounders are bottom feeders, and grouper and snapper are caught on the bottom too. This could account for the flounder's position, which is closer to the groupers/snappers than to the other inshore species.

Item-By-Use: Species Similarities and Difference

The West Florida matrix, like East Florida's, can be divided into two broad sections with regard to the species (items) and two broad sections with regard to characteristics or uses of those species. Species Clusters A to C represent the species that receive low scores on the edibility scale. Clusters D to F are those species considered good eating. Species in G represent an ambiguous, less well-known grouping.

By the the same token, those characteristics most cited when discussing preferred species fall into Use Cluster 1. Those characteristics considered bad fall into Use Clusters 3 to 7. Use Cluster 2 contains some good characteristics, such as "hard fighting fish," and some bad characteristics, such as "not hard fighting fish," which suggests disagreement within the West Florida fishing population.

Given other similarities between West and East Florida fishermen, a number of comments apply to both populations' matrices. West Florida fishermen assign poor quality characteristics to those species that fell into the trashfish, the small baitfish, the shark, and the inedible sportfish clusters in the HCL (see Figure 4). With the exception of being considered "hard fighting fish," the species in groups A to C did not receive favorable responses about of the quality of their meat, their versatility, or their ease of handling. The species are associated with smelly flesh,

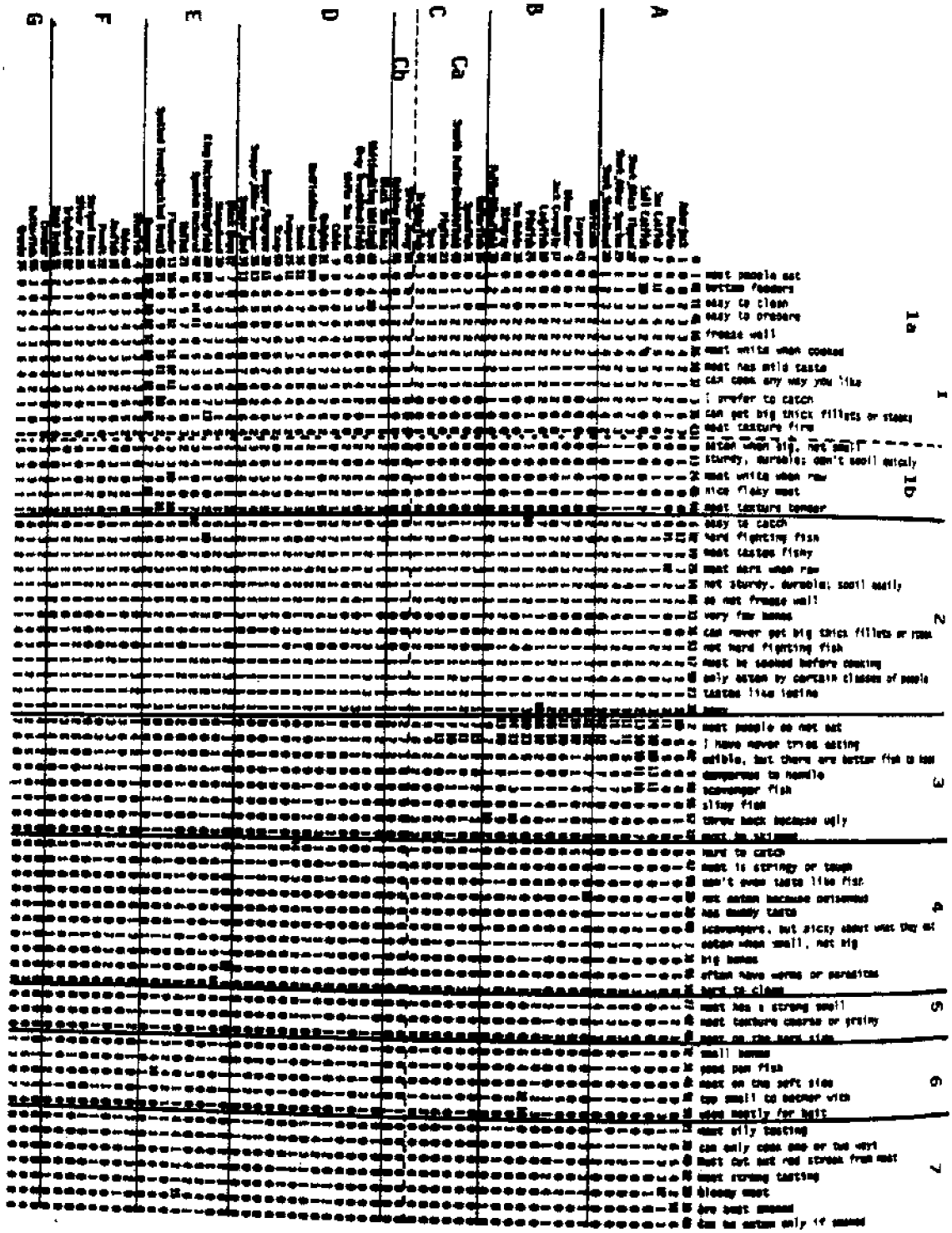


Table 10
West Florida Sorted Item-By-Use Matrix Based on
Row-Row and Column-Column Similarities

dark, bloody or fishy flavored meat lengthy preparation times to make the fish palatable; ugliness; danger; poison; and lower classes. On the other hand, the same positive characteristics associated with the preferred species in West Florida apply in East Florida: ease of preparation, versatility white flaky meat, and mild taste to the meat.

In terms of relationships among the sentence frames, fishermen cited "most people do not eat" and "I have never tried eating" for the same species with relatively high frequency. They demonstrated similar reactions to other undesirable characteristics -ugliness, dangerousness, sliminess, and skin texture. These characteristics (Use Cluster 3) are shared by the species in Cluster A and B and suggest that avoid species that fail to live up to the image of the ideal fish. Many relationships depicted in Figure 4 for East Florida could be used to describe these same relationships in West Florida. In addition to those already mentioned (e.g. ugly implies poisonous), the belief frames referring to darker meats (Use Cluster 7) again emerges and links amberjack and bonita with the more desired mackerels, mullet, and bluefish, suggesting similarities upon which we can build in an educational program. Finally, some species fall into clusters associated with undesirable characteristics because of their small size and because they are difficult to clean.

A few noteworthy differences exists between the West and East Florida matrices. The most noticeable differences are found in the species that fall into Clusters D and E, the two clusters containing West Florida fishermen's most prized species. These can be contrasted with species Clusters E and F in the East Florida matrix (see Table 9). In the East Florida matrix, the species in Cluster E and Ea are grouped together because of their meat qualities and good-eating characteristics. The darker-meat species fall into Cluster F. In West Florida, however, the species in group E are composed of a mixed bag of perceived meat qualities and edibility characteristics. These species seem to be united by a characteristics such as bottom feeding, big bones, and durability. This indicates that perceived relationships among preferred species in West Florida are more broadly based than are relationships among species in East Florida. It also suggests that lesser preferred species, such as black drum, sheepshead, and mullet, can be targeted for increased utilization based on the wide variety of characteristics they share with flounder, trout, and grouper. Despite a few differences between preferred species clusters, those species in D for West Florida and Ea in East Florida are nearly identical, consisting of supreme inshore and offshore meat fish and the good-eating sport fish.

Other differences between East and West Florida matrices involve shifts in the positions of species from clusters considered bad to clusters considered good, and vice versa. Triggerfish moved from a desirable cluster in East Florida to one containing garbage and smaller species in West Florida. However, about one-third of the West Florida fishermen had never eaten triggerfish. It may be lack of experience with Triggerfish that has led to its association with undesirable species.

Although the species in F and G suggest an improved position for such smaller species as silver perch, croaker, butterfish and grunts, these species are less known on the Florida Gulf Coast than elsewhere. Consequently, their improved positions may not be significant. Nevertheless, smaller fish are utilized more in western Florida than eastern Florida, where larger, "better" fish are available.

North Carolina

The North Carolina sample was drawn from the membership list of the Raleigh Saltwater Sportfishing Club. The shores of North Carolina that these fishermen use are characterized by a variety of fish habitats, including the massive sounds and estuaries that extend far into the state. Unlike Florida fishermen, North Carolina fishermen also have access to many species in Northern waters, but do not have ready access to tropical species. The diverse fishing environment in North Carolina, it will be seen below, impact on the attitudes that the state's recreational fishermen have about similarities and differences between saltwater fish.

Table B (Appendix C) shows how North Carolina fishermen described species of fish that they considered similar. North Carolina fishermen responded to the stimuli with different emphases than Florida or Texas fishermen, but similarities between the the three dimensions of sport, edibility, and range still exist. More than any other area's fishermen, North Carolina anglers emphasized characteristic suggested by the habits, habitats, and appearances of the fish. Thus, the majority of the sentences fall into the category of range or habitat. Classification criteria specifically citing sport or edibility characteristics occur with less frequency and usually in combination with range or habitat designations. These different emphases are less obvious in their effect on the clusters emerged from the HCL than in their effect on the MDS.

The following section discusses Clusters 1 through 6; Cluster 7, the sharks, requires no discussion.

Hierarchical Clustering Analysis

Cluster 1

Amberjack	Spanish Mackeral
Barracuda	Wahoo
Cobia	King Mackeral
Little Tuna	Snook
Dolphin	Tarpon
Atlantic Mackeral	

This cluster is composed of game fish. Unlike Florida fishermen, North Carolina fishermen made no distinctions between edible and nonedible game fish. Nor did North Carolina fishermen include in this category those game fish that are smaller, such as the runners, crevalle jack, or ladyfish. Thus, we can see that not only the sporting or fighting characteristics

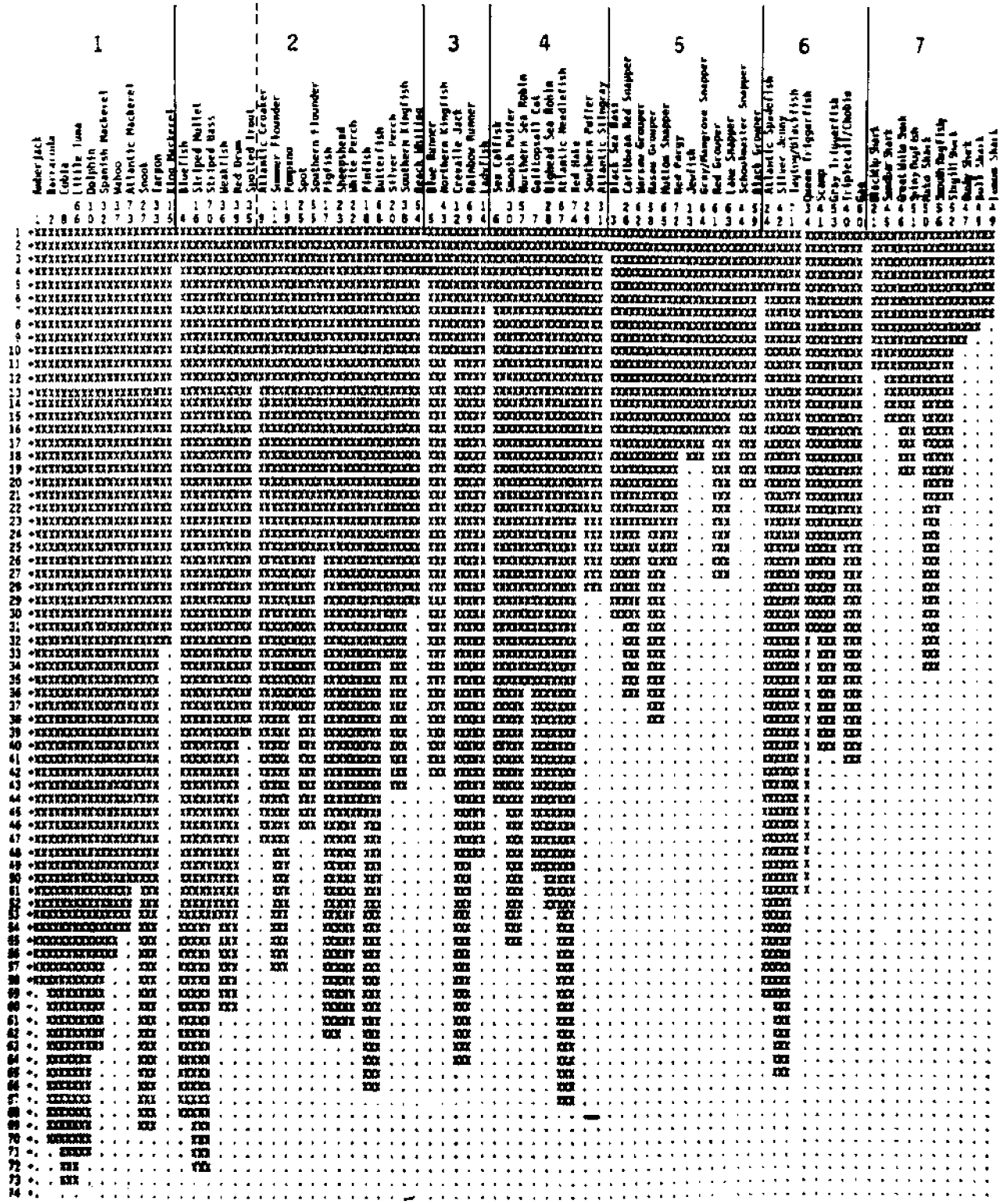


Figure 7
North Carolina Hierarchical Clustering Taxonomy

came into play here, but the size and shape of the species also played a part in determining this cluster's composition reflecting North Carolinians' propensity to group species by characteristics of the fish rather than the tastes or desires of the fishermen.

Cluster 2

Bluefish	Croaker
Striped Mullet	Summer Flounder
Striped Bass	Pompano
Red Drum	Spot
Spotted Trout	Southern Flounder
***	Pigfish
Butterfish	Sheepshead
Silver Perch	White Perch
Southern Kingfish	Pinfish
Beach Whiting	

This large cluster is composed of inshore species that are used for food and bait. As Figure 7 shows, there is some division in this cluster but not enough to warrant two separate categories. The species in the croaker segment tend to be the smaller bait fish.

This category points to the impact of species availability on the perception and desires of saltwater fishermen. The smaller species that are considered bait fish in East Florida occupy a status closer to the flounders and trouts in North Carolina. The lack of availability of large species in North Carolina, as opposed to the diversity of large species in East Florida, increases the value of smaller fish in North Carolina. But qualifying statements are necessary. First, it may be that North Carolina anglers catch fewer large species because they fish inshore locations more than Florida or Texas fishermen (see Table 6). Second, the smaller species may be in the same cluster with trouts and flounders because the criteria of inshore carries more weight than the criteria of meat fish. These alternate explanations, however, do not undermine the importance of pinfish, perches, pigfish, and other small species occupying a category along with the more widely desired species like trouts and flounders. Whether perceived as being similar because of range or because of taste, the fact that they are perceived as being similar in some fashion constitutes a basis on which to build an educational program aimed at increasing utilization of these smaller species outside of North Carolina. That these smaller species are in fact used for food can be seen in the quotes in Table 13, category F3, which refer specifically to smaller, inshore fish.

Cluster 3

Blue Runner
Northern Kingfish
Crevalle Jack
Rainbow Runner
Ladyfish

These species are also smaller inshore species, but, with the exception of northern kingfish, these sporty fish are not considered edible. Neither are these species widely known or experienced in North Carolina, and often these species were grouped together because of their shapes and names (Runners).

Cluster 4

Sea Catfish	Bighead Sea Robin
Smooth Puffer	Atlantic Needlefish
Northern Sea Robin	Red Hake
Gafftopsail Catfish	Southern Puffer
Atlantic Stingray	

These are the of trash fish, perceived as poor eating, difficult to clean, poor game fish, and nuisance species that get in the way of a good time.

Cluster 5

Black Sea Bass	Jewfish
Red Snapper	Gray Snapper
Warsaw Grouper	Lane Snapper
Nasau Grouper	Red Grouper
Mutton Snapper	Schoolmaster Snapper
Red Porgy/Silver Snapper	Black Grouper

These are the species associated with good food, headboats and satisfying and productive fishing. Although these are not good sport fish, they are the species fishermen seek when it comes to filling the cooler or freezer.

It is interesting that red porgy/silver snapper fell into this pile. Red porgy is a popular species in North Carolina, but less known than the snapper/grouper group. However, it falls into this cluster because of its common name, silver snapper.

Cluster 6

Spadefish	Gray Triggerfish
Silver Jenny	Gag
Tautog/Blackfish	Tripletail
Queen Triggerfish	
Scamp	

This is a curious group, containing less known species (silver jenny and scamp), best described as second-class offshore bottom fish. These species tend to be called "reef fish" by North Carolina fishermen. They are caught in the same areas as grouper and snapper. In all four areas, these fish elicited mixed responses. Some fishermen perceived triggerfish as only slightly better than trash fish. Others said, "Few people know that triggerfish's meat is snow white and flaky."

To increase utilization of the species in this cluster and similar clusters in the other areas (see Table 7) will require such things as educating fishermen about cleaning and cooking techniques. Those individuals who know how to clean and cook species in these categories rave about them.

Multidimensional Scaling Analysis

The propensity for N.C. fishermen to classify species of fish range, feeding habits, size, and shape, makes the interpretation of the MDS for North Carolina more difficult. The dimensions tend not to be clean continuums from game fish to non-game fish but instead incorporate other information such as shape and size. These are discussed specifically in the following section.

Dimension 1: Edibility. In order to visualize the progression from good to bad food fish, it is best to rotate the axis around 45 degrees. From the lower left corner of the configuration to the upper right corner, one gradually moves from the highly desired grouper/snapper species offshore and the trout and sheepshead inshore to the trash fish and sharks, needlefish, rays, and barracudas.

The interesting difference between this configuration and those from the other regions is that the smaller species, such as pigfish and the perches, fall at the good end of the continuum, suggesting that these species are more highly valued as food fish in North Carolina than elsewhere. We did, in fact, find that these species were utilized as food more in North Carolina than in the other regions, and information on targeted species from other sources supports this (Fricke 1984; Ditton and Holland 1984), especially with regard to spot and croaker. However, also influencing the position of these smaller species might be the appearance of these species. These smaller species look like groupers, snappers, trouts, and sheepsheads, with short, squatty, rounded bodies. This may influence the position of fish in the configuration. The species tend to become progressively slimmer and more pointed, like the sharks and needlefish, further from the good-eating end of the configuration. Those species at the upper right extreme also tend to be the fish with skin as opposed to scales. This may be a function of the common tendency for fishermen to associate a fish's ugliness or strangeness with inedible characteristics.

Despite the possible influences of shape and beauty affecting this configuration, the dimension of edibility seems to be the dominant one here.

Dimension 2: Range. Dimension 2 is less clear than dimension 1, although part of the confusion stems from a lack of knowledge about a few species. However, with the axis still rotated counterclockwise 45 to 50 degrees (see Figure 9), the progression from the upper left corner to the lower right corner loosely moves from offshore species to inshore species. The triggerfish, groupers, snappers, spadefish and other species are associated with party boats and offshore reefs or offshore bottom fishing. The flounders, trouts, croakers, spots and redfishes are perceived as pier or inshore species.

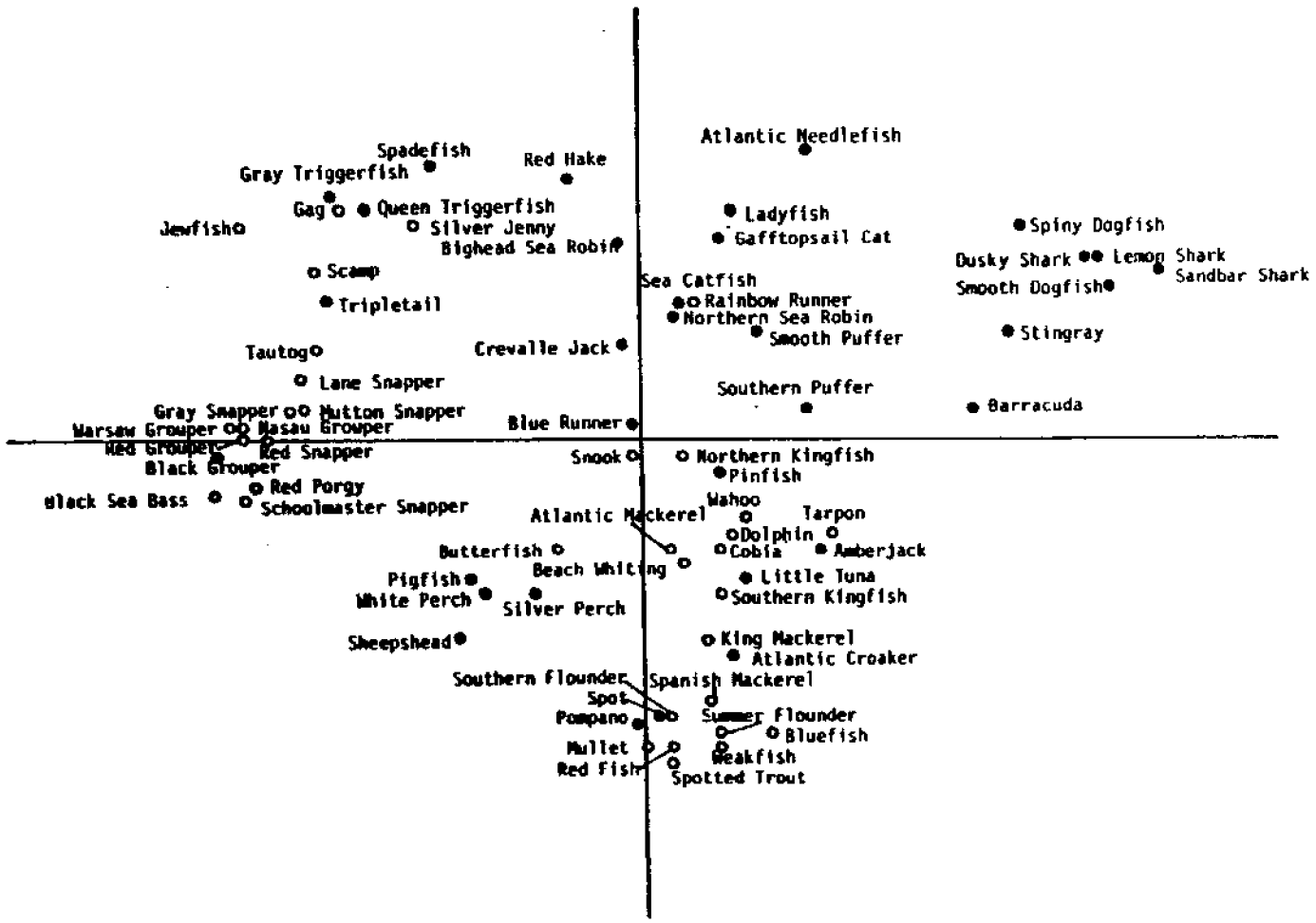


Figure 8
Multidimensional Scaling for North Carolina:
Dimension 1 vs. Dimension 2

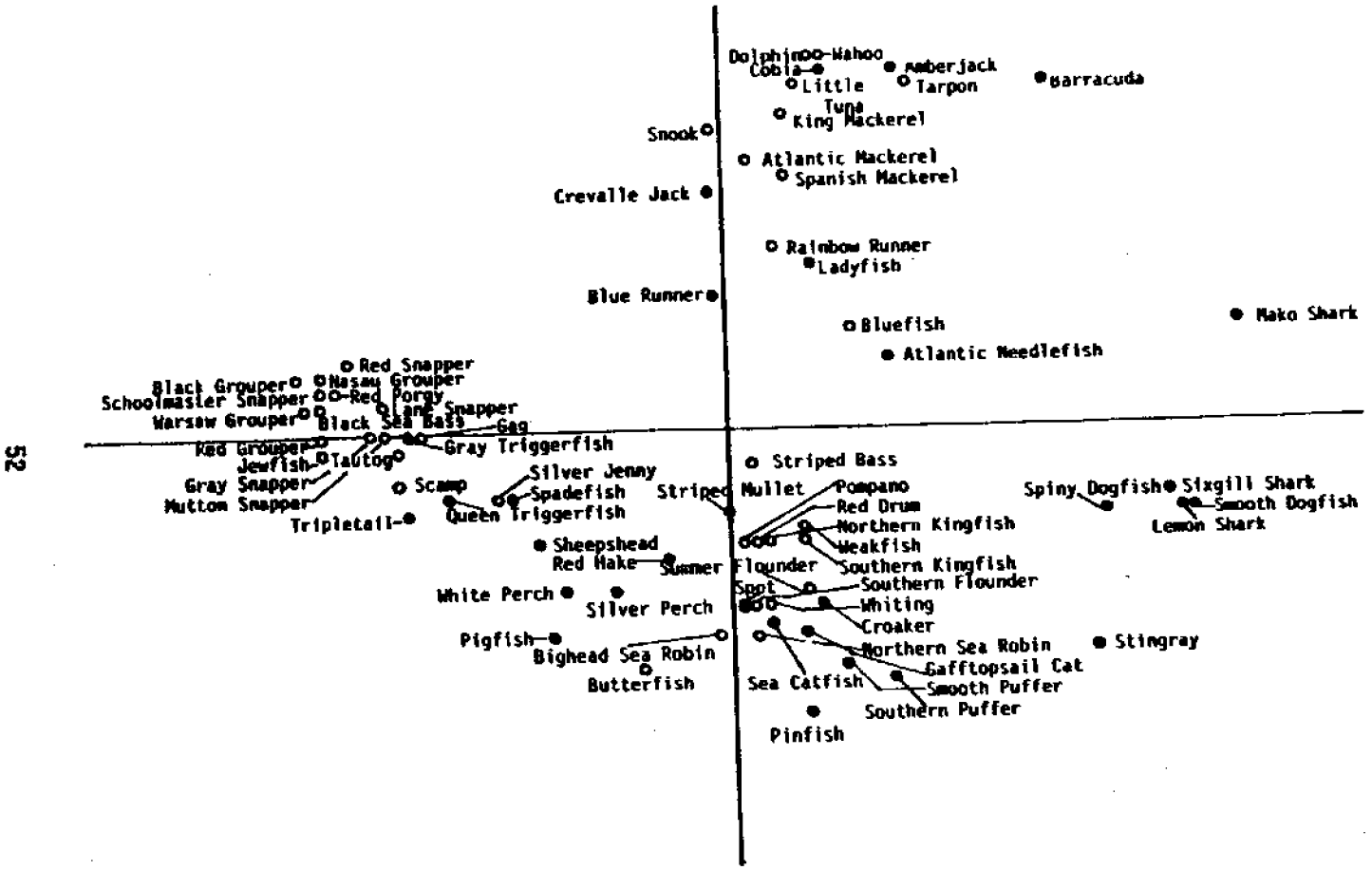


Figure 9
Multidimensional Scaling for North Carolina:
Dimension 1 vs. Dimension 3

Notable exceptions to this are dolphin, wahoo, and little tuna, which usually were seen as offshore species, but in the configuration lie at the same position as flounder. Crevalle jack is another species that seems misplaced appearing further to the offshore end of the continuum than dolphin or wahoo.

These exceptions make this dimension less informative than dimension 1 or dimension 3.

Dimension 3: Sport or Fighting Characteristics. In this dimension there is a gradual progression from game fish at the top of the configuration to the smaller, less exciting species at the bottom. The only major difference between this dimension in N.C. and the same dimension elsewhere is that the mako shark, like the blacktip in East Florida, is perceived as more of a game fish than the other sharks.

Item-By-Use: Species Similarities and Differences:

The North Carolina matrix demonstrates that recreational fishermen from different geographical regions agree in the ways they rank and value fish. Table 14 shows that the groups of uses are nearly identical to those of East and West Florida fishermen and, as it will be shown later, to Texas fishermen too. From region to region the species that satisfy the criteria change, but the criteria do not.

Again the species people prefer to catch, those in E and F, are easy to prepare, easy to clean, and have white meat. On the other hand, in North Carolina as elsewhere, the characteristics of ugliness, poisonousness, dangerousness, and difficulty in cleaning are associated with trash species.

How do the species preferences differ in North Carolina? The most striking difference involves the smaller fish such as croaker, spot and white perch. These species are well-known in North Carolina and widely utilized. Almost all fishermen have tried these species, which are categorized with highly desired species such as snapper and grouper. Their utilization in North Carolina demonstrates that they can be, through a socialization or education process, perceived as valuable species.

Two other species that warrant discussion are bluefish and tuna. These species have darker, bloodier meats, yet both fall into groups with preferred species. Other species with similar meats, such as amberjack, bonito, and Atlantic mackerel, were not included in the preferred species groups, despite good fighting characteristics. This segregation of dark meat fish occurs in all areas, with king mackerel and bluefish falling into the preferred groups and amberjack and bonito falling into the undesirable groups. Amberjack, again, was cited as being a host for worms and parasites, which may account for its rejection.

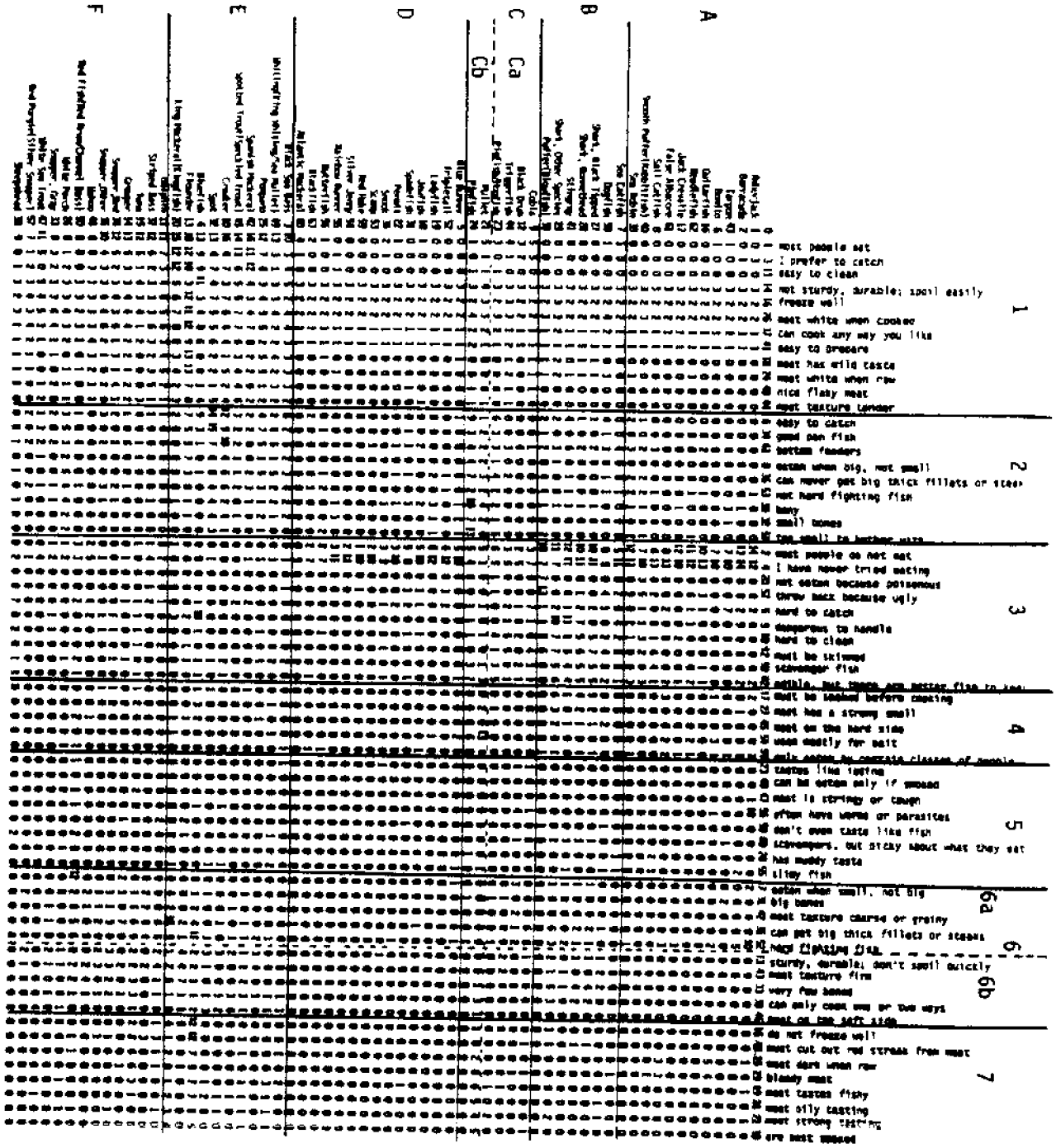


Table 11
North Carolina Sorted Item-By-Use Matrix Based on
Row-Row and Column-Column Similarities

Texas

The Texas sample was taken from the membership list of the Gulf Coast Conservation Association (GCCA), an extremely large and politically active group based in Houston (Ditton 1984). Those in our sample were familiar with many fishing environments, but primarily fished from boats in the Gulf of Mexico. This environment includes the warm, tropical waters near Yucatan, Mexico, as well as the oil platforms off the Texas coast, and the silt-laden waters off the Mississippi Delta. In addition, most fishermen were experienced with the Galveston Bay area, where the three Texas favorites - flounder, redfish, and speckled trout - can be caught.

The Texas fishermen tend to be unique because the HCL and MDS reveal large numbers of species at the extremes of preferred and trash. Few species occupy the middle ground. Table 7 shows that the Texas fishermen have no clusters of fish that fall in the second-class meat fish category. Instead many fish fall into a group of non-preferred, little known and trash species. Anglers obviously grouped species based on the simple criteria of fish they liked to catch and those they didn't In fact, Texas fishermen had the fewest number of clusters of the four regions. And these clusters revealed the largest number of rejected species. Consequently, the list of preferred species - good sport fish or good food fish - is considerably smaller in Texas than in the other three regions (see Table 7, column 4, rows 1-4).

Hierarchical Clustering Analysis

Cluster 1

Amberjack	Cobia
Barracuda	Spanish Mackeral
Pompano	Wahoo
Snook	King Mackeral
Tarpon	

Like North Carolina fishermen, Texas fishermen did not differentiate between good-eating and poor-eating sport fish.

Cluster 2

Summer Flounder	Southern Flounder
Sand Trout	Spotted (Speckled) Trout
Weakfish/Grey Trout	
Red Drum	

Nearly every Texas fishermen agreed that redfish, flounder, and trout were the most highly priced species in Texas. The GCCA has actively pushed for legislation protecting redfish and speckled trout. Virtually all Texas fishermen interviewed backed this legislation, and some recommended making the season and size limits even more strict.

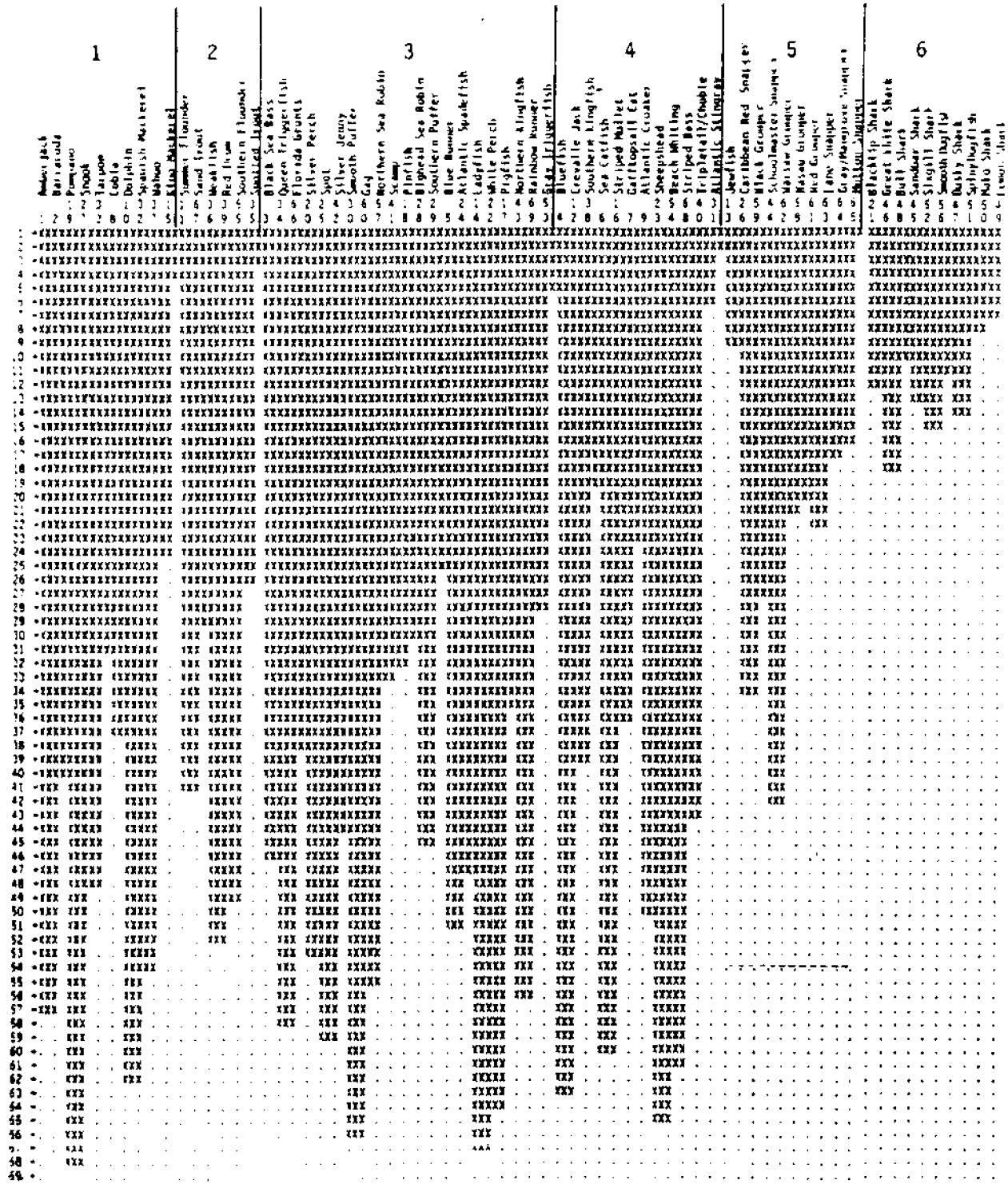


Figure 10
Texas Hierarchical Clustering Taxonomy

Clusters 3-4

#3:
Black Sea Bass*
Queen Triggerfish
Grunts
Silver Jenny
Smooth Puffer
Gag
Northern Sea Robin
Scamp
Pinfish
Bighead Sea Robin
Southern Puffer
Blue Runner
Spadefish
Ladyfish*
White Perch*
Pigfish
Northern Kingfish*
Rainbow Runner*
Gray Triggerfish

#4:
Bluefish*
Crevalle Jack
Southern Kingfish*
Sea Catfish
Mullet
Gafftopsail Catfish
Croaker
Sheepshead
Beach Whiting
Striped Bass*
Tripletail
Stingray

These clusters can be described as the fish in which Texas fishermen have no interest. They include the trash fish and the unknown species. The distinction between the groupings is that cluster 3 contains offshore species (excepting those which are unknown) and cluster 4 contains inshore species (excepting those which are unknown). Those species that are not known in Texas are marked with asteriks, and there are a number of these in each cluster.

Beyond this, cluster 3 contains fish that are perceived as slightly better than the species in cluster 4, such as the triggerfish and black sea bass. But the core group of the trash fish (catfish, puffers, sea robins, and stingray) are evenly distributed between the two clusters. Consequently, these species are best described as the non-preferred species of Texas, a designation that is reflected in the MDS.

Cluster 5

Jewfish
Red Snapper
Black Grouper
Schoolmaster Snapper
Warsaw Grouper
Nasau Grouper
Red Grpuper
Lane Snapper
Gray Snapper
Mutton Snapper

These are the offshore, bottom-feeding, food fish revered by fishermen everywhere.

Multidimensional Scaling Analysis

The extremes of preferred species and non-preferred species represented in the HCL are reflected in the MDS for Texas. However, because Texas fishermen separate species in an either/or way, the dimensions of the MDS do not reflect edibility and sporting characteristics as clearly as the MDS for the other regions.

Dimension 1: Preferred vs. Non-preferred Species. This is the only dimension for the Texas sample that is clear. The species Texas fishermen prefer fall at the right side of the configuration, extending from the dolphin to the black grouper and including the majority of the fish in clusters 1,2, and 5. The species to the left of this group fall into the undesirable and unknown camp, including the fish in clusters 3, 4, and 6.

Dimension 2: Size, Shape, and Sporting Characteristics. With the exception of jewfish, most of the species above the horizontal axis in Figure 11 are smaller fish. They are squatty, rounded species and small, inshore species. Those fish below the horizontal axis are longer, thinner, larger than those above the axis. This dimension could be considered a progression from sport fish at the bottom to non-sport fish at the top, but this is not as clear as the sporting dimension in East Florida. The Texas fishermen share a common trait with West Florida fishermen who also fish the Gulf of Mexico. Both samples show a more favorable attitude toward sharks than Atlantic Coast fishermen. Among Texas fishermen sharks occupy a position almost level with sport fish such as barracuda, tarpon, wahoo, and dolphin, but they still fall at the non-preferred end of Dimension 1. Sharks may constitute a potentially successful species to target for increased utilization.

Dimension 3: Edibility. Although not as well-defined as elsewhere, Figure 12 shows that species considered edible lie at the top of the configuration, and those considered poor eating lie in the lower quadrants. Exceptions are cobia, dolphin, wahoo, and the mackerels, which lie below the horizontal axis, but are considered edible, and the sharks and puffers, which lie above the axis, but are rejected as food.

Item-By-Use: Species Similarities And Differences

The Texas anglers have the smallest number of preferred species of the four samples, ranking speckled trout, flounder, and redfish above all other species and indicating a lack of concern or familiarity with most other species. Despite this restricted focus, the characteristics that describe the preferred species - white meat, easy to clean, easy to prepare - do not change in Texas.

The general division between preferred and undesirable species occurs in the line between butterfish and bluefish. Those species in clusters A to C are the species about which Texas fishermen seem unconcerned. The mullet is in its worst position in Texas. It is considered inedible, and over 50 percent of the fishermen have never eaten it (rows 2,4). Also, the species in these clusters have have darker, bloodier, stronger smelling and tasting

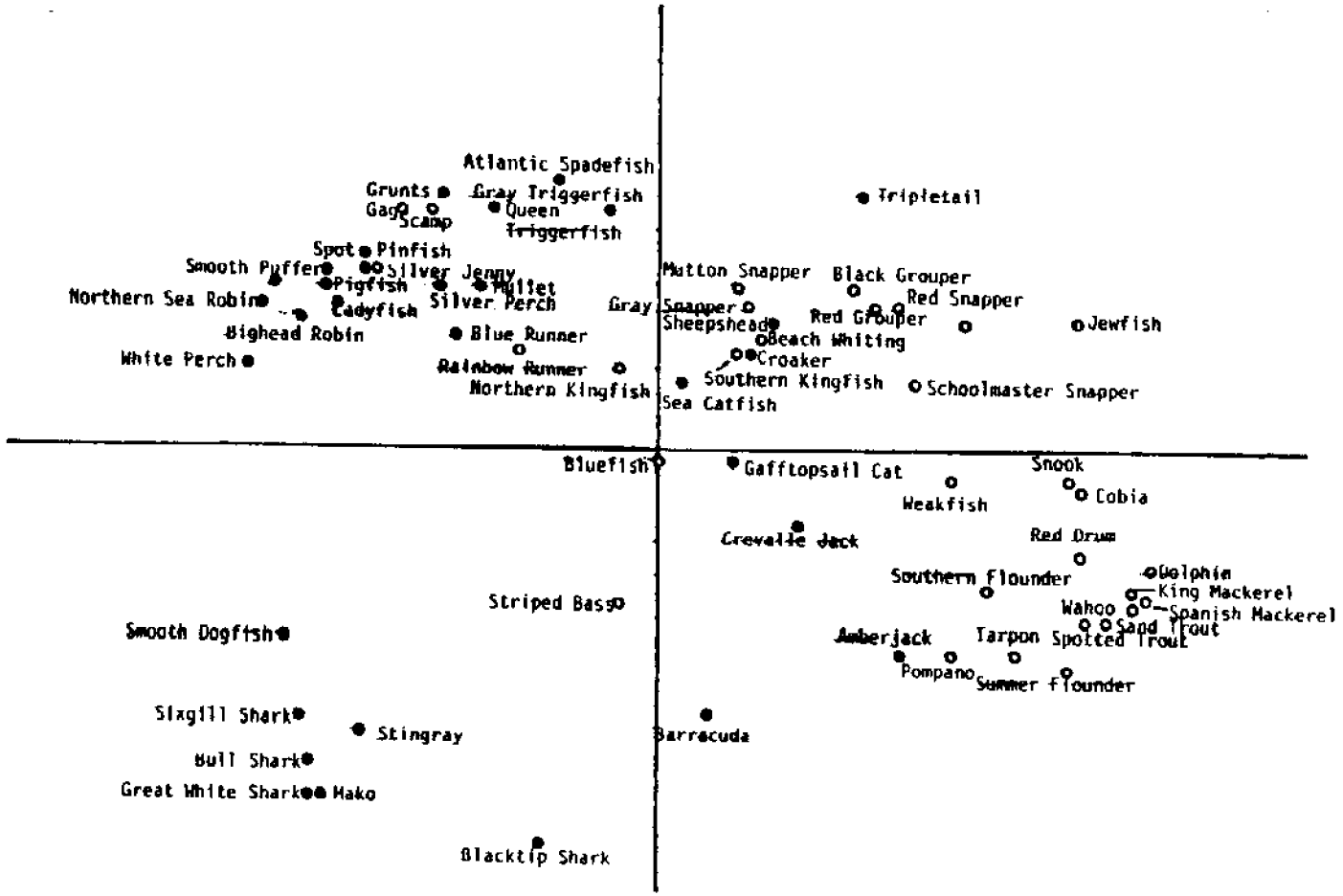


Figure 11
Multidimensional Scaling for Texas:
Dimension 1 vs. Dimension 2

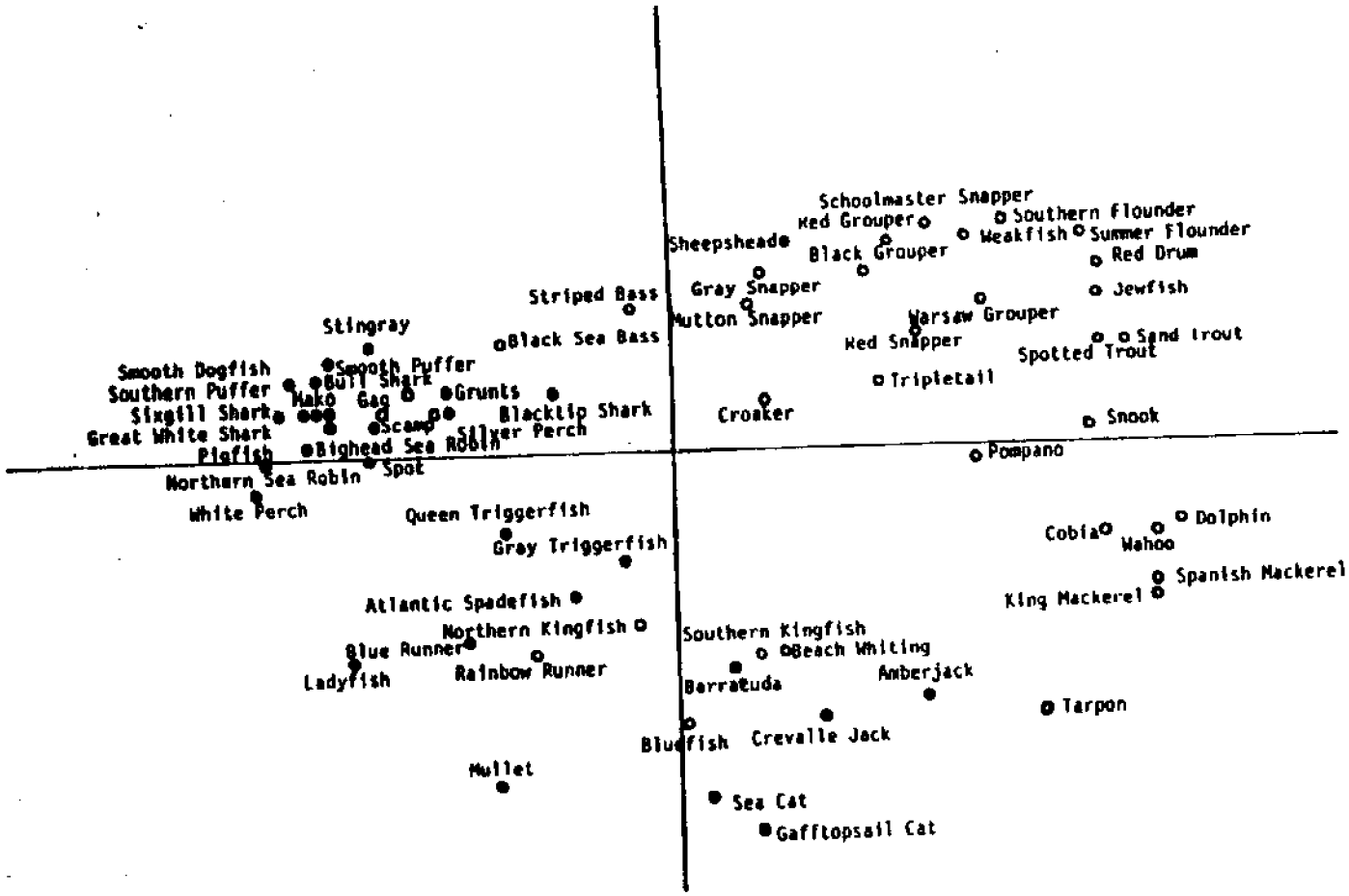


Figure 12
Multidimensional Scaling for Texas:
Dimension 1 vs. Dimension 3

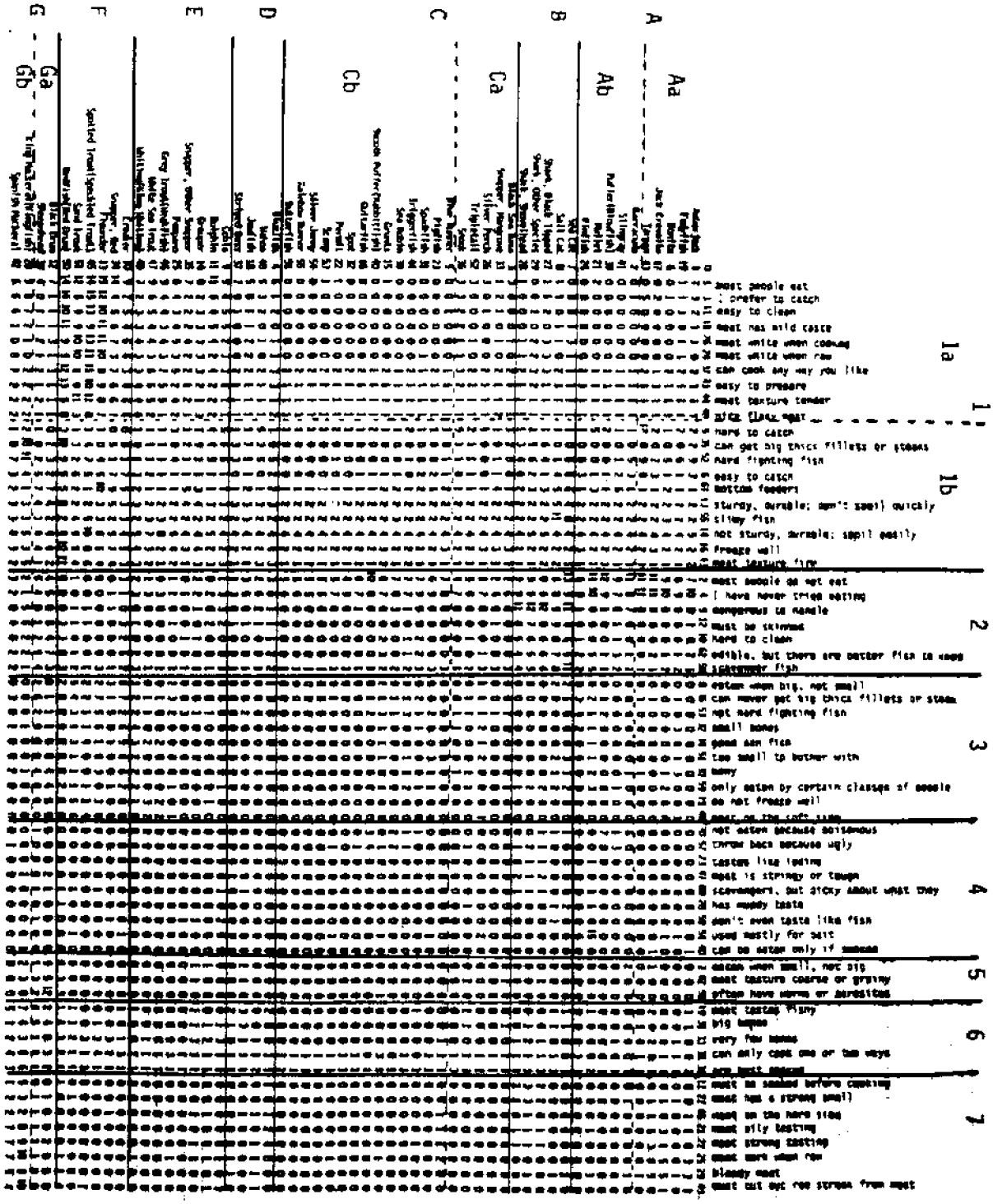


Table 12

Texas Sorted Item-By-Use Matrix Based On
Row-Row and Column-Column Similarities

meat. Except for Spanish and king mackerel and bluefish, all the f
clusters D to G are seen as mild tasting fish. Finally, croaker ha
improved in the perceptions of fishermen in Texas, falling into the sam
group as flounder, redfish, and trout. This suggests that encouraging th
use of smaller bait fish in Texas and elsewhere is possible based o
similarities of meat quality and textures between these fish and specie
such as flounder and trout.

REGIONAL COMPARISONS

In this section, we compare and contrast regions on the basis of socio-demographics, similarities in perceptions of belief-frames, and differences in perceptions and utilizations of fish species. Intra-regional comparisons of socio-demographic variables were subjected to discriminant analysis based on area groupings. Comparisons among the belief-frames for these areas will be based on the correlation of similarity matrices used in the item-by-use analysis. Finally, regional perceptions of fish species will be compared and contrasted based on a visual interpretation of the item-by-use matrices, the multidimensional scaling outputs, and the hierarchical clustering analysis.

Socio-demographic Comparisons

Sample areas were compared on the basis of number of trips fished last year; percent of fishing activity from boats, surf, fixed structures, and charter boats; and age, education and income of respondents. Discriminant analysis was used to statistically compare the areas based on the variables above. We found that after the inclusion of the eight variables only six remained following the procedure. These included number of fishing trips last year, percent of fishing activity from boats and fixed structures, and income, education, and age of respondents. The final table of F statistics and significances between pairs of groups is shown in Table 17. The two areas with the most similarities with respect to these items are the Texas and North Carolina samples.

Table 13

F Statistics And Significances Between Pairs Of Research Areas After Step 6

	East Florida	West Florida	Texas
West Florida	2.6400 p=.0213		
Texas	4.4765 p=.0005	6.4580 p=.0000	
North Carolina	6.3381 p=.0000	8.2234 p=.0000	1.2774 p=.2762

These comparisons are not central to the analysis of the data, but are presented to give background for understanding the characteristics of each sample. The similarities in the above variables between North Carolina and Texas are hypothesized to result from occupational and residential factors. Informants from both areas were younger with higher incomes. In addition, these respondents live further from the water than anglers in West and East Florida. This implies fewer opportunities to fish because of logistical and occupational constraints.

Belief-frame Comparisons

Belief-frame similarity matrices for each area were correlated against one another. The results are seen in Table 18. As is evident from the table, there is a reasonably high degree of agreement between areas as to similarities among species attributes. We would expect to find more continuity in the relationships among belief-frames expecting most of the regional variation to occur with respect to perceived similarities among fish species. Of particular interest was the higher degree of similarity between the Texas sample and the North Carolina samples. This was consistent with our findings on regional similarities based on socio-demographic variables. We cannot, however, make any statements about the interaction of cognitive and other sociological variables as they relate to our study.

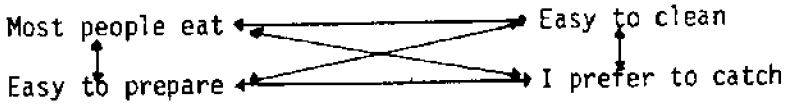
Table 14
Correlations Among Belief-Frame Similarity Matrices
For The Four Research Areas

	East Florida	West Florida	Texas	North Carolina
East Florida	1.00000 p=.00000	0.73935 p=.0001	0.70291 p=.0001	0.74631 p=.0001
West Florida		1.00000 p=.00000	0.69459 p=.0001	0.72765 p=.0001
Texas			1.00000 p=.00000	0.77914 p=.0001
North Carolina				1.00000 p=.00000

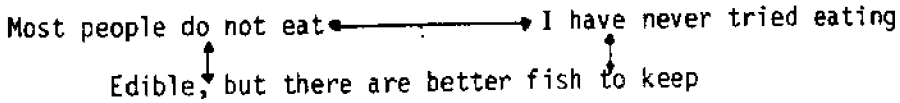
Figure 13 shows logical relations among belief frames for the East Florida sample based on a more general application of D'Andrades (1976) subset-superset comparisons. It is our purpose at this point to identify logical relations at a general level that may give insight into the cognitive processes that lead to acceptance and rejection of certain fish. We use East Florida as an example since all regions share similarities in the structuring of relations among belief-frames.

The first cluster of belief frames shows general relationships discussed earlier. The fish most people eat and prefer to catch are generally perceived as easy to prepare and clean. In contrast, the second cluster shows that if a fish is not eaten it is generally because there are better fish and, more importantly, because they never have been tried. This suggests that fishermen are rejecting species based on information such as rumors gained in an unempirical fashion.

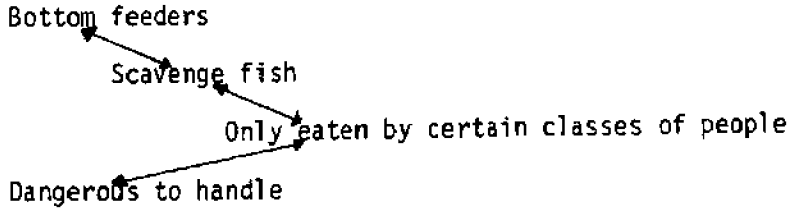
Cluster three shows the relations among more negative attributes. Not surprisingly, scavengers, who are often bottom feeders, were viewed as



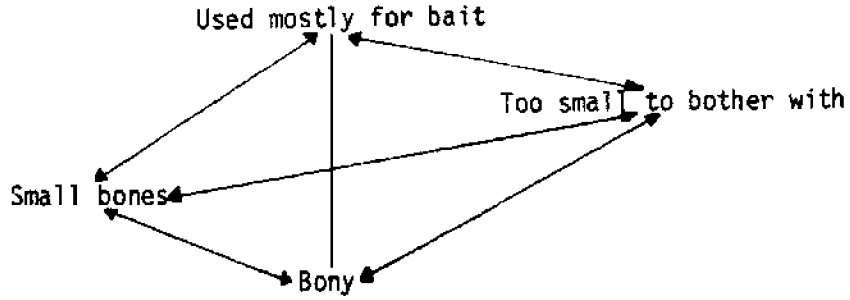
Cluster 1



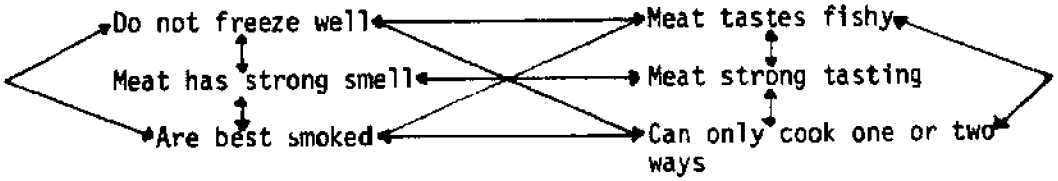
Cluster 2



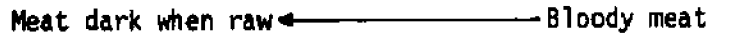
Cluster 3



Cluster 4



Cluster 5



Cluster 6

Cluster 7

Figure 13: Logical relations among attributes.

being eaten by certain classes of people (e.g., lower classes). Also, a tendency exists for species perceived as dangerous to be related to this same attribute.

Cluster four shows relations among attributes that stem from the size of fish. Fish that are "too small" (relative to available species) are used for bait and have small bones that influence their food value.

Cluster five illustrates relations among characteristics that describe the attributes of the fish's meat and its storage and cooking characteristics. The species are king mackerel, bluefish, mullet, and to a lesser extent, amberjack. A logical relation is cluster six. These fish are viewed as having bloody dark raw meat and share some of the perceived characteristics found in cluster five, such as "do not freeze well."

Cluster seven exhibits the more interesting relations among attributes. In this particular case, fish that are considered "ugly" are perceived as poisonous. The notable exception is the stingray. However, it may be that species not resembling fishermen's conceptions of what a fish "should" look like are associated with other negative attributes (poisonous) because of unusual morphological characteristics.

Thus, fishermen tend to prefer species that are perceived as easy to deal with, good tasting, and/or are challenging to catch. These characteristics account for the results of the multidimensional scaling. These findings, in conjunction with the item-by-use matrix, show we can increase utilization of underutilized species by building on species' characteristics that make them easier to deal with or exciting to catch. This process will involve increasing recreational fishermen's knowledge about certain species and clearing up misconceptions about certain species. The low response to species like triggerfish and sheepshead, especially concerning the quality of their meat, may stem from a lack of experience with these fish and a lack of knowledge about how to cook and clean them. This ignorance effectively reduces the ease with which fishermen can deal with these species. Fishermen must expend more effort and energy to handle these species because they must take additional steps to learn how to cook and clean them. Unless they possess such prior knowledge, lesser-known species are unlikely to be utilized.

These findings suggest that most perceptions concerning underutilized species are developed outside actual experiences. Beliefs relevant to these species are generally the result of hearsay and rumor perpetuated during a fishermen's socialization into recreational fishing. For the purposes of this study, these findings are important. If fishermen had actual negative encounters with certain underutilized species, programs, like the one suggested here, would have limited success. In other words, ambiguities about the perceptions of underutilized species and lack of experience with such species provides opportunities for the development of a successful program.

Comparisons in Perceptions

The above discussion was characterized by agreement between regions in terms of the dimensions of edibility and sport, the criteria underlying the hierarchical cluster analysis output, the perceived good and bad characteristics of species in the item-by-use matrices, and those species that comprise the "core groups" of species defined by fishermen. Throughout the Southeast, fishermen categorized saltwater species similarly (although specific species in the categories change from region to region), and targeted or rejected species based on these shared perceptions. Although the agreement is pan-regional at a general perceptual level, the specific knowledge and comments about species varies slightly from region to region. Within this realm of variance we find useful information concerning the cognitive orientations toward, and consequent use of, saltwater species of fish.

In every region, fishermen have the same attitude toward sea robins, the puffers, the two catfish, and the stringray, and most comments and attitudes that apply to these apply to the sharks and dogfish too. These are the trash fish. As figure 13 shows, these species correspond with those clusters of belief frames that include the designation: "most people do not eat." This description is accompanied by "dangerous to handle," "edible, but there are better fish to eat," "scavenger fish," "hard to clean" and, in all but Texas, "poisonous," and "ugly." Most importantly, the belief frame "most people do not eat" occurred in a cluster with "I have never tried eating," suggesting that the attitudes toward these species were learned from others rather than from personal experience. That these species are "ugly" may be only characteristics that is perceived through first-hand experience. During the interviews, we encountered fishermen who released species such as sharks and catfish, often after killing them, without any more involvement with the fish than a twist of the hook. In these cases, fishermen may associate puffers, sea robins, catfish, rays, and sharks with negative characteristics on rumor alone.

These unfavorable characteristcs are not the only grounds for rejecting species. A second group of negative characteristics involve the quality of the meat. Fishermen in all the regions tend not to eat the dark meat fish or those with a strong smell, muddy or strong taste, or bloody flesh, preferring instead the mild, white, flaky, tender meat associated with grouper, snapper, and flounder. Yet their rejection of some dark meat species is contrasted by a preference for king mackerel and bluefish.

This brings us to a crucial point. For every criteria by which fishermen reject species, there is at least one species that possesses the negative quality but which is preferred. For example, in Texas, redfish, the most highly prized fish, shares nearly every positve and negative characteristic with the little utilized black drum. In North Carolina, the small, unpreferred species such as mullet, pinfish, and pigfish share many characteristics with croaker and spot. In East and West Florida, bonito's and amberjack's meat qualities and fighting characteristics overlap with king mackerel's and bluefish's in the minds of fishermen, who reject the former two species yet prefer the latter.

Moreover, nearly every species that suffers from negative labeling is rejected because of only a few characteristics, yet possesses positive characteristics that could put it among the ranks of targeted species. Puffer, which suffers from a reputation for being poisonous, has a meat quality and versatile preparation potential similar to grouper or cobia. Although sharks require extensive preparation steps (e.g., must be skinned, meat soaked), they yield thick fillets and have few bones, characteristics that reduce time spend handling the species during other preparation phases. Amberjack, which is cited as worm-infested, is a hard fighting fish and known by some as being excellent to eat if properly bled.

There are some notable intra-regional differences in how fishermen classify species. They include the relatively high value given mullet in West Florida and its low value in Texas, and the greater value placed on smaller species such as croaker and spot in North Carolina as compared to East Florida.

Also, North Carolina fishermen prefer a proportionately wider variety of inshore and offshore species, including large and small fish, than other area fishermen. Table 7 shows that North Carolina fishermen included the most species in the two preferred species categories -- the sport fish and meat fish categories (I and II). These fishermen have access to a broad range of ecological areas, including large sounds, inlets, sheltered bays and open sea. Despite varied ecosystems, North Carolina anglers do not have easy access to tropical species or the Gulf Stream. This reduces the range of species from which they choose and makes some smaller species more desirable in North Carolina than in other areas. In East Florida, fishermen often cited the wide variety of species as a reason for East Florida fishermen's selectivity.

Nevertheless, a high degree of selectivity in recreational fishing results in fishermen targeting species that conform to the ideal. This also often leads to fishermen cognitively classifying species based less on the fish themselves than on the way one interacts with the fish, or one's preferences (e.g. "These are fish I like to catch."). Also, ready availability of a variety of species means that East Florida fishermen can catch preferred species without extensive knowledge of the fish's range, habits, or habitat. North Carolina anglers cannot afford to be too selective or they might never catch fish. And becoming as familiar as possible with the species that are available increases one's chances of catching fish -- you know where to fish at which times of the year, what you'll catch, etc. A cognitive side effect of this familiarity is that species become more distinguishable from one another on the basis of characteristics specific to the fish -- their habits, appearances, and ranges.

On the other hand, Texas fishermen demonstrate the most selective, most personal means of classifying saltwater species. The item-by-use matrix and the comparisons with other areas in the HCL (Table 7) demonstrate that Texas fishermen have the fewest number of preferred species, reject or do not care about the largest number of species, and get enthusiastic only over redfish, speckled trout, and flounder. Although some Texas fishermen

distinguish species by range, size, shape, and family relationships, the MDS output revealed the clearest classification basis was preferred versus non-preferred. In particular, the preferred three listed above emerged as a special class of fish in the HCL and item-by-use clusters.

However great these regional differences may seem, they are set against a background of overwhelming pan-regional agreement concerning what makes a good and a bad saltwater fish. Those characteristics serve as bases for the rejection and the targeting of species represent the underlying cognitive structures which unite marine anglers throughout the Southeast. However, regional socialization into the recreational fishing experience, the availability of species, the diversity of environments and access points and the sources of recreational fishing information function to modify, lengthen, shorten or revise the list of desirable and undesirable species from region to region. They intervene between the underlying cognitive structures and the final decisions to target, reject, utilize, or scorn a fish. Yet those intervening factors that revolve around the socialization of marine recreational fishermen can be modified to increase the list of targeted saltwater fish.

RECOMMENDATIONS

In this section we discuss the application of our findings for the selection of species that have potential for increased utilization. There are two categories of fish that correspond to two different sets of recommendations and two different strategies for increasing their utilization. It is crucial to make a distinction between fish that have potential for increased utilization based on substitutability and those that have potential as primary target species. In some cases we will find species of fish that, because of some minor negative attributes, will never be a deliberate target of anglers but will be incidental in nature. Some incidentally caught species, traditionally throwbacks or trash fish, can be positively presented to anglers as substitutes in lieu of preferred species or as additions to the overall catch. The second category of fish constitute species that have the potential to become primary target species for many recreational fishermen, but have never been utilized because of unknown or misunderstood attributes.

We shall begin our discussion of recommendations with those species in the second categoy, for these illustrate most clearly the kinds of gains which can be made by overcoming just a few misconceptions or making available a small piece of information.

Silk Purses Out of Sows' Ears.

A recurrent theme in many recent recreational fishing magazines is the idea of discovering new prizes among the same old catch. The May, 1984 issue of Field & Stream, for example, ran an article entitled "Treasures Among the Trash," about catching locally scorned whitefish while trout fishing and finding the fillets to be "white, flaky, and delicious" (Strung 1984: 74). Another article, in Saltwater Sportsman, begins with the comments of a surprised angler who, after avoiding Sheepshead for years, learns that his friend has always actively sought them. "One good day of sheepshead fishing with Davis changed my mind about the value of the saltwater zebra. Having feasted on the species since then, it has become a prize for which I actively search" (Phillips 1984: 49). With Phillips's sudden change of heart comes an altogether new way to refer to the old species, too: instead of sheepshead he's catching "saltwater zebra" and "convict fish" (ibid.: 49-50), just as puffer served in restaurants has become sea squab or chicken-of-the-sea. Along with increases in sharkfishing tournaments and clubs, and new recipes and cookbooks for little-known or little utilized species, these examples suggest that America's saltwater sportfishermen are trying to make the most of the sea's resources.

Whether they perceive more desirable species to be declining, or ecological changes like El Nino currents have actually made species scarce, fishermen have begun to search for alternatives, new species to target, catch, clean, eat, and mount fish, to keep their sport as lively, bountiful, and exciting as ever. This has been a process, most commonly, of discovering that the alternatives have always been there, in the open, obvious, but alternatives that for one reason or another have been overlooked.

But how do we convince fishermen that there are, in fact, "treasures among the trash"? How do we change their minds? We use the cognitive raw materials provided by the fishermen themselves, making the less desirable species look more like the more highly desired species. Those species which seem to be the most likely candidates for such an endeavor, in all regions, comprise the following four groups:

Group A:	Group B:	Group C:	Group D:
Amberjack	Blacktipped Shark	Sheepshead	Barracuda
Bonito	Lemon Shark	Queen Triggerfish	
Tuna	Mako Shark	Gray Triggerfish	
Atlantic Mackerel		Black Drum	

These species represent four different groups with regard to the tactics used to increase their utilization. This is because they are rejected on the basis of four different sets of characteristics. They therefore need to be handled separately. However, it is important to recognize that these species represent other, similar species which could also use "face lifts" to improve their desirability. For example, although only the above species were included in our study, the tactics used to improve Amberjack could also be extended to other underutilized species of the Jack/Tuna/Mackerel types of saltwater fish.

Group A:

These species, rejected primarily because of the quality of their meat, already share some characteristics with other preferred saltwater species. The key to increasing their utilization is thus a joint process of stressing their good characteristics and playing down the bad. Their primary good characteristic, of course, is that they are considered hard fighting fish. These species also tend to yield thick fillets, and thus could appeal to fishermen on the grounds that they are relatively easy to clean, yielding alot of meat per unit of energy expended in the cleaning.

On the negative side, however, that which is gained in ease of cleaning due to the thick fillets is lost in the additional effort needed to bleed these species or cut out their bloodlines. Yet this is not in itself a bad enough characteristic to cause the wholesale rejection of these species. As mentioned above, the dark, bloody, oily, red-streaked meat is a characteristic of the mackerels and bluefish as well as the jacks and tunas. Of course, there may be objectively or subjectively recognizable differences between preferred dark-meat species and the non-preferred dark-meat species in terms of the strength of their bloody or oily flavors; bonito may in fact be stronger tasting, fishier, bloodier, or oilier than bluefish, for example. Neverthless it is widely known that strong-tasting fish, even as strong as Crevalle Jack, tend to make the best chowders, and dark, oily meats are much preferred to light, mild meats for smoked fish.

The primary reason underlying the undesirability of these species is very likely that they simply have no tradition of utilization. Amberjack is the best example of this and the species with the highest potential for

increased utilization. The story of amberjack's rise to popularity in West Florida, told above, is indicative of the ambiguity surrounding these darker-meat species. Many brochures advertising headboats throughout Florida -- including the Daytona area -- list amberjack among the species targeted by captains, yet many fishermen interviewed had never heard of eating amberjack and consequently never had eaten it. Others rejected it because of its reputation as a host for worms or parasites, stating that its tail section is usually filled with worms the size of one's forefingers. Certainly the simple association of one part of its body with worms is unpleasant enough to some to reject the entire fish. However, those fishermen who do routinely utilize amberjack -- and who, by the way, have nothing but praise for it as a food fish -- stated that they utilize the shoulder section, where there are, evidently, no worms.

What else do the fishermen who routinely utilize and praise amberjack say about it? Looking at the item-by-use matrix for West Florida, where amberjack was preferred by the largest proportion of fishermen (27.7%), we see that these fishermen who are most familiar with amberjack say that it is not only a hard fighting fish yielding thick fillets, it also has white meat when it's cooked, and its meat texture is firm. These latter characteristics it shares with grouper, snapper, cobia, whiting, and other species in the preferred group. Fishermen interviewed also said that amberjack, fried up the same day it was caught, tasted nearly identical to grouper and was, as mentioned previously, served on a seafood platter in a St. Petersburg restaurant as "grouper fingers." Others said that, once bled and with the blood line cut out, amberjack yield nich white fillets.

In any case, most fishermen agree that the species in this group, if cooked at all, are best smoked. Those who have fish smokers and who smoke alot of fish also point out that these species are the best species to smoke, as mentioned above, because their oily meats do not dry out as, say, a grouper's would. One of the past presidents of the Old Salt Fishing Club in West Florida, well-known throughout the club as a master fish smoker, said that nearly any oily fish was good smoked. The trick to smoking, evidently, is matching the correct woods up with the right fish. Hence, some experimentation may be necessary to match species with woods for smoking.

Finally, the major key to increasing utilization of these species, and possibly making them target species, is teaching fishermen the ways in which to make the meat of these species more desirable. This would include specific, step-by-step information on how to bleed them and cut out their bloodlines, as well as diffusing the technology of smoking, including experiments and taste-test information on the best locally available woods to use for specific fish. Dissemination of this sort of information would probably lead to increased utilization and the targeting of these species because it would make these species easier to deal with than they are now, thus making them more like those species that are already preferred. Fishermen already know that these are good fighting fish; increasing their status as food fish by these means would thus likely lead to their promotions to the positions of desired, welcomed, even targeted saltwater fish.

Group B:

All sharks are not equal. Although the most experienced shark fisherman will attest to this, sharks elicited the same response from almost every fisherman interviewed, in every region. With few exceptions, fishermen grouped all sharks (and dogfish) together in the pile-sort tasks. Without exception, all sharks fell into the same clusters in the HCL outputs and Item-by-Use matrices and occupied identical or neighboring coordinates in the MDS configurations. Finally, few fishermen had anything good to say about the sharks and dogfish.

The strategy of increasing the desirability of this group is not unlike the strategy used by a well-known aspirin manufacturer in recent years to increase their share of the over-the-counter pain relief market. This company blitzed television and magazine audiences with old myths that have since been dispelled (e.g. "the world is flat"), following this up with another supposed myth: "All aspirin's alike." Their point, of course, was that all aspirin was not alike, just as ours, here, is that all sharks are not alike, contrary to current recreational fishing thought. Those species singled out above are, according to experienced, discriminating shark fishermen, good-eating or good sport fish or both. Still, they have suffered from their association with other, urine-tasting, dangerous, tough-skinned sharks.

First, the primary reason all sharks are rejected is that they're "dangerous to handle." We encountered horror stories about sharks involving lost limbs, close brushes with death by bleeding, wrecked deck furniture and the like. Certainly stories like these diffuse through recreational fishing networks wherever and whenever fishermen gather. Certainly, too, the danger of some sharks is real. Again, however, being dangerous to handle is not by itself enough of a reason for rejecting a species. The item-by-use matrices for all areas show that other, preferred species -- notably King Mackeral, Cobia, Wahoo, and Bluefish -- also receive relatively high scores in the belief frame "dangerous to handle." Besides, whether or not a species is dangerous to handle depends to a large extent on the tools used for handling them. A recent article in Saltwater Sportsman had this to say about handling sharks:

When sharking, I carry a club (darned near a baseball bat, actually) that will subdue a big fish if I plan to keep it for eating. Wire cutters are employed if the quarry is to be set free. . . .It is wise to carry a sturdy rope so that you can render the fish's tail helpless after clubbing. They won't give up without a struggle (Green 1984: 42).

The point here is that there exist tools such as clubs, ropes, gaffs, and guns to subdue sharks. Finally, many fishermen interviewed already kill the sharks they encounter, believing them to be a menace. Outside Hollywood, it is difficult to conceive of a dead shark being very dangerous.

In addition to being perceived as dangerous, sharks are also associated with other "bad" characteristics involving their cleaning, preparation, and

edibility. First, they tend to be seen as scavenger fish, a characteristic which is sometimes associated with tainted flesh. However, during the preliminary interviews in Texas, investigators found that other, preferred species which were perceived as "scavengers" or "bottom feeders" were also described as being "picky about what they eat." This suggests that cognitive means exist for rendering the designation "scavenger" harmless or neutral.

Second, sharks are often seen as being "hard to clean," or they "must be skinned," along with the general perception that shark meat "must be soaked," "has a strong smell," is "stringy or tough," and has a texture that is "coarse or grainy." These characteristics, in combination, are quite a lot to overcome. Again, however, their difficulty in cleaning is counterbalanced by their ability to yield big, thick fillets or steaks. Also they are seen as hard fighting fish, a fact which is backed up by the continuing rise of sharkfishing tournaments and clubs.

Yet how many of the "bad" characteristics apply to all sharks equally? According to discriminating fishermen who target some species of shark, the black tip and the lemon shark are, among all those presented to fishermen in the sample, the best tasting species. The MDS outputs for the various regions also demonstrate that these two species are perceived to be slightly different from the other sharks. Not only did some fishermen in our sample distinguish between edible and nonedible or undesirable sharks, others do as well. A fishermen in Saltwater Sportsman reports: "I would rate the sevengill and sixgill shark above such paragons of table virtue as swordfish, dolphin, halibut -- even salmon" (Green 1984: 42). In the Southeast, we might add lemon and black tip shark to this list as well.

Finally, many fishermen who actively seek shark do so because sharks are, as mentioned above, seen as good fighting fish. Certainly this is their most redeeming characteristic in recreational fishermen's eyes. The three sharks chosen here -- the black tip (spinner), lemon, and mako -- have the greatest potential for increased utilization because they stand apart from the whole, negatively perceived group of sharks. The black tip and lemon were perceived as good to eat as well as fun to catch; the mako already has something of a reputation as a fighting or sport fish; the black tip is also known to leap and spin when hooked (hence its other name, "spinner"). Concentrating more energy on these three sharks, apart from the others, might help pave the way toward increasing the utilization of them first and, later, other sharks as well. The long-term strategy here is therefore an initial process of singling out these three sharks (as well as others known to be good eating or exceptionally lively fighters), pointing out means of cleaning and cooking them as well as ways to render them less dangerous. Following the spread of this information, one could subsequently use these more highly desired sharks to increase and enhance shark fishing in general.

Group C:

These species' major "bad" characteristic is their reputation for being "difficult to clean." They are, already, utilized by many fishermen in

each region; however, their utilization could be increased with the dissemination of a few photographs demonstrating, step by step, how one can easily clean these fish.

Those fishermen who have eaten them attest to the goodness of their meat, and these species are likely to be best targeted as "good table fare" or meat fish. They tend not to be hard fighters, although sheepshead are, evidently, challenging to catch, being known as "the fish you have to hook before it strikes." It was not uncommon for sheepshead and triggerfish to be favorably compared to grouper and snapper. Black drum and sheepshead suffer from what could be called a negative prestige rating: in all areas except North Carolina, they score higher than preferred species on the sentence frame "only eaten by certain classes of people." Also, black drum is perceived in every region as a common host for worms or parasites. It shares this dubious distinction with redfish, a fish highly desired in every region. We point out, however, that these two fish also share the perceived characteristic of being edible when small, but inedible as they grow larger. Investigators found that larger red and black drum were though to be greater risks for worms or parasites than smaller individuals. In any case, the fact that red drum is preferred, despite the large individuals having worms, suggests that having worms or parasites as large fish is not enough cause to completely reject a species.

Group D:

Barracuda's only stumbling block to increased utilization is a major one: like puffer, nearly every fisherman in every region believes barracuda to be poisonous. Fishermen specifically cite ciguatera as the poison. Although large grouper and snapper are also implicated as common carriers of ciguatera, evidently the barracuda at the top of the food chain is perceived as the most likely candidate.

Fishermen who would eat or had eaten barracuda (one after feeding it to his cat), however, generally agreed that its flesh was good to eat and its temperment similar to that of hard fighting fish. Its only real drawback to increased utilization is its reputation, evidently valid in some areas (Sea Stats 1984), as a ciguatera carrier. Encouragement of barracuda as a food fish is thus dependent upon information and recommendations of those knowledgeable about the range of the ciguatera toxin.

Incidental Catch

In the introduction to this section we distinguished between species that were good candidates for increased utilization as target species, discussed above, and those which may be utilized more as substitutes for some species or as additions to the overall catch. It is the second category to which we now turn. The species discussed here are unlikely to emerge as target species actively sought by fishermen. They are, for example, too small, or else not really very good to eat or fun to catch. However, they do tend to be caught with other, preferred species, some with a great deal of frequency. In fact, many fishermen grouped species together by the very criteria of their being caught together: the criteria of range. This

suggests similarities of food supply with preferred species, similar habits, and similar techniques of catching them. As a general comment, the similarities which derive from common habitats or ranges of species might serve as useful tools for aiding in clearing up misconceptions, and making some less desirable species "look" more like preferred species.

We have placed these less desirable speices in the following groups, which can be considered recommendation domains, because their similar characteristics make the strategies to increase their utilization similar also.

Group A:	Group B:	Group C:
Jack Crevalle	Northern Sea Robin	Gafftopsail Catfish
Ladyfish	Bighead Sea Robin	Southern Puffer
Blue Runner	Sea Catfish	Smooth Dogfish
	Smooth Puffer	Spiny Dogfish
	Skates and Rays	

Group D:

Croaker	Grunts
Spot	Perches
Pinfish	Mullet
Pigfish	Spadefish

Group A

These species are perceived fas strong-tasting, dark-fleshed, bony, smelly, bloody, oily fish. It is highly doubtful that they will ever achieve reputations as targeted or preferred species. Nevertheless, one characteristic that unites these species is that, though small, they are vicious little fighters and make exceptionally fun catches using light tackle. They have good potential as candidates for light tackle tournaments. Ladyfish, in particular, was seen as a small cousin to the Tarpon, which evidently jumps free of the water and thrashes about when hooked.

Perhaps one strategy here would be to organize or aid in the organization of tournaments oriented toward younger saltwarer fishermen, such as elementary school and junior high school children for whom these species might present a challenge and thrill. Another suggestion would be to target these species in so-called "powder puff" tournaments, or tournaments for women. Members of the Halifax Sportfishing Club in Dayton Beach, Florida, were considering reinstating an annual "powder puff" component to the well-known striking fish tournament. Evidently these activities are not uncommon.

Finally, these species, as noted above and mentioned by some fishermen in our sample, evidently provide good sources of meat for fish chowders, since strong meats flavor water more thoroughly than mild fish flesh. These species also tend to be bony, however, and their rise to preeminence as

food fish is not to be expected in the near future.

Group B

These represent the bottom of the cognitive barrel and the least likely species to ever be specifically targeted. According to fishermen, they are not hard fighters. Attempting to sell them on that basis is probably a lost cause. These species do tend to be quite frequently caught, however, and with improved images they may be kept as additions to the catch or as substitutes on slow days.

In the above analysis we discussed these species and their negative characteristics in various contexts. By now their reputations as being ugly, poisonous, dangerous, too small, scavengers, and so on are well known. Overcoming these reputations involves a joint educational process of 1) clearing up misconceptions (e.g. puffer flesh is poison); and 2) diffusing information concerning how to handle, clean, and cook these species. Again, the dissemination of this kind of information will improve the image of these species by making them easier to deal with. A few simple facts about cleaning and cooking these species, once known, will allow fishermen to take fewer cognitive steps from catching them to using them, thus making their utilization easier for the fisherman who is, after all, out there to relax.

Although the dissemination of this information will rely on formal channels initially, such as though Marine Advisory Service agents, eventually information on the cleaning and cooking of these species should become part of the cognitive repertoire of socialization into recreational fishing. The seeds of this information need only be strategically sown among, for example, boat captains and tournament participants.

Group C

Like the sharks in the previous section, these species all share the common condition of guilt by association. They were grouped with the undesirable trashfish and sharks in the clusters in all regions (except puffer in West Florida), and fell nearby the other trashfish in the MDS outputs. These species, however, all elicited favorable comments from recreational fishermen in each region, yet their utilization was confined to only a small proportion of those interviewed.

The strategy necessary for increasing utilization of these species is, again, one of getting fishermen to see that they differ in fundamental ways (especially taste and fight) from other fish that are perceived to be their siblings or close cousins. Gafftopsail catfish, for example, received favorable comments from at least one fisherman in Texas, one in West Florida and one in East Florida: compared to sea catfish, its flesh is whiter and less muddy-tasing, and its larger size sometimes makes it a hard fighter from which one can slice big fillets. Its problem is that fishermen simply see it as no different from sea catfish and reject both.

Southern Puffer suffers from a similar problem, in addition to its reputation as a poisonous fish. That is, southern puffer is a larger fish than smooth puffer, and evidently has more meat on its tail section than the smaller puffer. Its flavor as a delicacy is well-known, and increasing its utilization as a food fish would not be difficult with a few samples distributed at boat shows and tournaments. However, it still is associated with the smaller, smooth puffer, which, along with sea robins, was rejected for being "too small to bother with." Fishermen said they were "all head, no body." Yet those who ate Southern Puffer said that one could easily get two nice fillets -- like chicken breasts -- from the tail section.

Finally, the dogfish were considered good-eating fish by a few North Carolina fishermen, and distinguished from sharks by some West Florida fishermen, but they still suffer from their association with the sharks. Although nowhere praised as good sportfish, their utilization may be increased by pointing out their eating characteristics and distinguishing them from the sharks.

Group D

The principal complaint levied against these species concerned their size. They were, nearly everywhere, considered "too small to bother with." This designation is a relative one, however, and some of these species tend to be utilized in some areas and tossed back in others. Croaker and Spot are probably two with the greatest potential for increased utilization, especially in East and West Florida, because they are already utilized somewhat in Texas and North Carolina.

Unlike freshwater fishermen, saltwater fishermen seem to be interested in catching large fish. The same fisherman who will keep freshwater brim or smallmouth bass weighing under a pound will throw back fish this size when fishing in the ocean. Yet many fishermen in our sample recognized these smaller species as "good pan fish," although most said they were small, bony, and bothersome. In Ponce Inlet, an avid fisherman said that he used pinfish in a lobster-newberg type casserole the same way people use other substitutes like popcorn shrimp or small saltwater crayfish.

Thus, although these species are small, they share many of the same edibility characteristics as more highly desired species. They can be recommended for increased utilization by pointing out the good qualities of their meat, through the spread of panfish cooking techniques and recipes, and as species that may be kept in lieu of a large catch of bigger and more preferred fish.

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FOOTNOTES

1. These tasks involve sorting cards with pictures of fish into piles on the basis of perceived similarities between species(see Appendix). Respondents were then asked to explain why they grouped fish togeather as they did. Responses were recorded in detail but usually consisted of no more than one or two sentences such as "These are reef fish," "These fish are fun to catch for sport but no good to eat," or "These are trash fish, a waste of bait and tackle." In most cases, following completion of the pile sort task, fishermen discussed various aspects of fishing in their areas with the interviewer, and notes were made concerning the substance of these conversations. Respondents were also asked a series of questions concerning length of club membership, number of fishing trips per year, percentages of fishing done from a boat, beach, or structure, cooking and cleaning fish, and demographic information (see attachments). Following this task, interviewers gave respondents the sentence completion questionnaire and accompanying fish list and stamped envelope, going over the instructions for completing the questionnaire with respondents. Respondents were told that this was not a test of their knowledge but similar to an opinion survey, and were asked to devote an equal amount of thought and effort to every question, and were asked to fill out the questionnaire in a single sitting, if possible. Respondents were also told that the questionnaire could take them as long as two hours to complete.

2. The similarity measure based on information theory tends to weight finer distinctions (i.e., smaller piles) among species more heavily. We found that some of the highly educated respondents would often sort species based on scientific taxonomic criteria. These finer distinctions based on scientific rather than recreational, sport or edibility criterias would be heavily weighted thereby under estimating other more important sorting criteria.

3. Random selection was based on a fortran program seeded by an integer value which is the current contents of a 36 bit machine clock incremented every 2.4 microseconds.

4. Both parametric and non-parametric statistics were included to show significance in either case.

5. We mention this at this point because we had originally thought that utilization of various species might be influenced by those who clean and cook the fish. If we had found that wives were responsible for all cooking and cleaning of fish, then this would have influenced whom we perceived to be the most appropriate audience for the educational program. However, because recreational fishermen tend to be men and tend to clean and, in many cases, cook the fish they catch, we will orient the educational program for the male recreational fisherman.

6. Sentences and phrases in quotes are direct quotations from the fishermen interviewed. Each set of quotes represents a different speaker in each category. Comments in parentheses are those of the

interviewer, paraphrasing fishermen's comments. Numbers in brackets refer to the number of fishermen who cited the statement during the interviews.

Appendix A

Explanation of Survey Instruments

Attached are lists of fish species for each area, a cover page for general information on the respondent, and a sentence completion questionnaire. Each card portrayed a picture of a single species, the scientific name of the species directly beneath the picture (in italics) and then the common local names of the species in bold print. The local names were based on preliminary analysis and interviews with fishermen in each of the four target areas. The pictures were taken from The Dictionary of Fishes, a popular guide by Rube Allen for identifying saltwater species of fish.

The page entitled "General Information on Respondent" was administered by the interviewer, and the fishermen were then left with a copy of the other fish list, the sentence completion questionnaire, and a stamped envelope. Fishermen were told to use the numbers from the fish list in completing the sentences on the questionnaire.

GENERAL INFORMATION ON RESPONDENT

NAME:_____ ASSIGNED ID#:_____

MAILING ADDRESS:_____
(RESIDENCE)
CLUB AFFILIATION:_____
LENGTH OF MEMBERSHIP:_____
ESTIMATED # OF FISHING TRIPS LAST YEAR:_____
ESTIMATED ALLOCATION OF FISHING EFFORT (TYPE OF FISHING):
BOAT_____% BEACH/SURF_____% STRUCTURE_____% CHARTER/PARTY___%

FISH PREPARATION: (SCALING, FILETING, READYING FOR STORAGE AND/OR COOKING):
SELF_____% OTHER (SPECIFY)_____% OTHER (SPECIFY)_____% OTHER_____
_____ _____ _____

COOKING OF FISH:
SELF_____% OTHER (SPECIFY)_____% OTHER (SPECIFY)_____% OTHER_____
_____ _____ _____

TYPES OF COOKING STYLES FOR FISH CAUGHT BY RESPONDENT:

BROIL_____% DEEP FRY_____ PAN FRY_____

BAKE_____ BARBECUE_____ SMOKE_____

OTHER (SPECIFY)_____

OTHER (SPECIFY)_____
_____

DEMOGRAPHIC INFORMATION:

AGE OF RESPONDENT:_____

EDUCATION_____

EST. HOUSEHOLD INCOME_____

OWN BOAT?_____

COMMENTS:

_____
_____
_____
_____
_____
_____
_____
_____
_____

SENTENCE COMPLETION SECTION

ID#:_____
NAME:_____

Instructions

The following sentences are statements about fish that are caught by recreational fishermen. Using the FISH LIST that is supplied. Please write the number for any fish that you feel could be used in the sentence. Please write these numbers on the line beneath each sentence. Note that more than one fish may be used for each sentence.

Part I - General Questions

1. Most people eat_____.
_____

2. Most people do not eat_____.
_____

3. I prefer to catch_____.
_____

4. I have never tried eating_____.
_____

5. _____are hard fish to caught.
_____

6. _____are easy fish to caught.
_____

7. Usually, fishermen don't eat big _____but will eat the smaller ones.
_____

8. Usually, fishermen don't eat smaller_____but will eat the bigger ones.
_____

Part II - Handling, Cleaning and Storage

1. _____are dangerous fish to handle.
_____

2. It is hard to clean_____.
_____

3. It is easy to clean_____.
_____

4. In order to eat_____it has to be skinned.
_____

ID#:_____NAME:_____

5. _____are sturdy or durable fish: you don't have to worry about them spoiling very quickly.

6. _____are not sturdy or durable fish: they spoil easily.

7. _____do not freeze very well.

8. _____freeze very well.

9. The meat of_____has to be soaked before cooking.

Part III - Edibility, Preparation, and Cooking of Catch

1. _____has a real mild taste to the meat.

2. The meat from_____tastes fishy.

3. _____are usually not eaten because they can be poisonous.

4. The meat from_____is oily tasting.

5. _____is strong tasting.

6. The meat from_____often has an iodiny taste (tastes like iodine).

7. When cut open,_____has real white meat.

8. When cut open,_____has dark meat.

9. When cooked, the meat from_____is white.

10. The meat from_____has a strong smell.

11. There is a muddy taste to the meat of_____.

ID#:_____ NAME:_____

12. _____have bloody meat.

13. _____are bony.

14. _____have a lot of big bones in them.

15. _____have a lot of small bones in them.

16. _____have very few bones.

17. _____are good pan fish (body fried whole in pan).

18. You can get big thick fillets or steaks from_____.

19. You can never get big thick fillets or steaks from_____.

20. _____can be cooked just about anyway you like.

21. _____can only be cooked one or two ways.

22. _____are best if they are smoked.

23. _____can be eaten only if they are smoked.

24. _____is very easy to prepare.

25. When cooked, the texture of the meat from_____is coarse or grainy.

26. When cooked, the texture of the meat from_____is firm.

27. When cooked, the texture of the meat from_____is tender.

28. When cooked, the meat from_____is on the hard side.

ID:_____NAME:_____

29. When cooked, the meat from____is on the soft side.

30. When cooked, the meat from____is stringy or tough.

31. _____has nice flaky meat.

32. The red streak of meat should be cut out of_____before eating.

33. _____don't even taste like fish.

Part IV - Characteristics of the Fish and Misc.

1. _____are usually too small to bother with.

2. _____are very hard fighting fish.

3. _____are not hard fighting fish.

4. _____is used mostly for bait.

5. _____are slimy fish.

6. Big_____often have worms or parasites and are thrown away.

7. _____are thrown back because they look different from other fish (they look ugly or awful).

8. _____are scavenger fish.

9. _____are eaten by certain classes or types of people.

10. _____are scavenger fish, but are picky about what they will eat.

11. _____are bottom feeders.

ID#:_____NAME:_____

12. Though edible people usually don't keep_____because there are so many other better fish to keep and eat.

_____

XXXX

FISH LIST

Accompanying Belief-Frames

1. Amberjack
2. Barracuda
3. Black Sea Bass
4. Bluefish
5. Blue Runner
6. Bonito
7. Sea Catfish
8. Sail Catfish
9. Cobia
10. Croaker
11. Dolphin
12. Black Drum
13. Flounder
14. Grouper (All species)
15. Grunts (All species)
16. Guitarfish
17. Jack Crevalle
18. Jewfish
19. Ladyfish
20. King Mackerel (Kingfish)
21. Mullet
22. Permit
23. Pigfish
24. Pinfish
25. Pompano
26. Silver Perch
27. Shark, Black Tipped
28. Shark, Shovelhead
29. Shark, Other Species
30. Sheepshead
31. Spadefish
32. Spot
33. Snapper, Mangrove
34. Snapper, Red
35. Snapper, Other Snapper
36. Snook
37. Striped Bass
38. Sea Robin
39. Puffer (Blowfish)
40. Smooth Puffer (Rabbitfish)
41. Stingray
42. Spanish Mackerel
43. Tarpon
44. Triggerfish
45. Spotted Trout (Speckled Trout)
46. Grey Trout (Weakfish)
47. White Sea Trout
48. Wahoo
49. Whiting (King Whiting)
50. Redfish (Red Drum)
51. Sand Trout
52. Tripletail
53. Scamp
54. Silver Jenny
55. Rainbow Runner
56. Butterfish

Appendix B

Stress Figures for three dimensional configurations:

Texas	0.171
E. Fl	0.170
W. Fl	0.157
NC	0.145

Appendix C

The following tables show fishermen's responses to the question, "Why did you put these fish together in the same pile?"

Table A
Criteria By Which West Florida Fishermen Classify Saltwater Species
By Major Category

A. Edibility (Including species-specific comments about edibility):

1.
"Meatfish. Fish I keep or put in the boat to sell." "Good quality eating fish. Best for home use and sale. Most lucrative." "Eating fish. Smaller fish but well eaten." "Marketable fish, food. Super! Good!" "Edible fish. Something most fishermen desire to catch, not particularly because of sport, but for food." "Excellent food fish which are fun in a way but not 'fun-fun' fish. Not great sport fish unless you want to pull them off the bottom." "Top edible fish."

2.
"Edible fish." "Eating fish."

3.
"Mullet is a food fish."

4.
"Edible sharks."

5.
"Non-edible sharks."

6.
"Non-edible trash." "Non-edible fish."

7.
"Good, lucrative, and you can pass them off as the fish of the day." "Edible. Second category of edible." (Somewhat less desirable than most desirable food fish).

8.
"Good quality eating fish but bigger, tougher." "Bigger fish, good eating."

B. Sport or Fighting Qualities:

1.
"Sport fish. Recreational fishing fish. Not necessarily food to eat, but fun to catch." "Fighting fish." "Game fish." "Beauty and fighting fish. Good fighting fish."

2.
"Trolling fish." "Most, except amberjack, caught trolling. But all good game fish." "Trolling fish. You catch these fish while you're trolling." "Most caught by trolling. Sport fishing."

3.
"Heavy sport fish."

C. Range or Habitat:

1.
"Bridge or shallow boat fishing fish. I don't have the patience to fish for 'em." "Inshore fish." "Inshore type fishing fish."

2.
"Offshore fish." "Deep water fish." "Bottomfish, but found mostly on rock." "Deep water fish, and grouper family." "Deep water bottomfish." "These don't come inshore, so I don't fish for them." "Snapper/grouper type fish. These are bottom fish. You fish for them on the bottom."

3.
"Wreck fish. Fish you catch on wrecks off shore."

4.
"Boat fish; I don't fish for them."

5.
"Fish you catch around rocks."

6.
"Common fish. Fish caught a lot around here." "You catch these fish all over the place, in different places on different kinds of tackle."

7.
"Fish I would like to fish for, but not found around here."

D. Combination Edibility and Sport:

1.
"Sport fish. Most of them good eating. Ladyfish is fun to catch but no good to eat." "Fun fish, especially on light tackle, and good eating." "Fish you catch for fun; sport fish which are edible, except Tarpon." "Good sport fish; good eating fish. Fish I'd be very glad to catch."

2.
"All eating fish, not recreational sport fish."

3.
"Great game fish but of no food value." "Fun fish to catch but no food value." "Fish you catch for fun; sport fish, not edible." "Highly sporting fish, but not edible." "Sportfishing fish. Not necessarily to eat."

4.
"Fun fish to catch, half decent to eat."

5.
"Eating and light-tackle fish."

6.
"Nuisance fish which I will use for bait sometimes and will eat sometimes, but only seldom."

7.
"Nuisance fish. Fun to catch, especially ladyfish."

E. Combination Edibility and Range/Habitat:

1.
"Fine eating fish. Sandy bottom eating fish." "Reef fish. Groupers, snappers. Primarily fish for these."

2.
"Edible fish which I fish for off the pier." "Edible bay fish, caught in the bay."

3.
"I release these fish when I catch them; they're not eaten in Florida."

F. Combination Sport and Range/Habitat:

1.
"Inshore game fish I like to fish for. Close to-shore sport fish. I don't specifically target them, but I do fish for these."

2.
"Inshore sport or fun fish."

3.
"Surface running game fish."

G. Miscellaneous:

1.
"Sharks. I don't like sharks." "Sharks/stingray. Don't like sharks. I'm happy not to see them." "Sharks are sharks. You catch them by accident. I never fish specifically for sharks." "Sharks and barracuda. Most of them have the same attitude. If they're hungry they'll eat what's there, including humans. Dangerous attitude. Nasty!" "Sharks. Junk. You could put them into the junk pile." "Sharks. Some good, some bad. Just sharks." "Sharks. Some edible, but undesirable." "Sharks, ray, and barracuda. All in the same family and mostly aggressive." "All these fish are sharks."

2.
"I don't know about this (sixgill) shark; I have never seen it."

3.
"Slop fish. Garbage." "I prefer not to catch them. I don't mess with them. Fish I'd just as soon not catch." "Fish I don't mess with. If you can't use 'em, what's the use of catching 'em?" "Fish I throw back." "Fish I don't fish for." "Fish that just come along any time. I don't fish for them." "Junk. Bait and stuff like that." "Junk fish. They're okay, but I don't mess with them." "Little food value, not much game value. Trash fish." "Junk fish. Something I don't fish for." "I don't fish for these." "Junk fish." "Nuisance fish I use for bait now and then, but not always." "Nuisance fish I use for bait." "Nuisance and trash fish." "Garbage fish."

4.
"Nasty fish. Good to eat but nasty. Ugly, slimy."

5.
"Fish I don't fish for." "Fish that just come along any time. I don't fish for them."

6.
"Bait fish. Use for bait. Good bottom-fishing bait." "Bait fish, but mullet is good to eat." "Strictly bait fish." "Bait fish." [8] "Shark-bait fish."

7.
"Shape of them." "Silver in color with a long and slender build." "Weird looking fish." "Flounder. Different shape." "Sleek, pointed bodies." "Shape of the head and the fins." "Weird fish, different looking." "Shape of the body, with short fins and short tails." "Sloping head and wide tails."

8.
"All in mackeral family because they all have dark meat."

9.
"Stingray in a class of his own. Different from others." "Ray has a different shape. Good for scallops -- the ultimate taste in scallops."

10.
"Catfish are hard to prepare." "Stingray are hard to prepare."

11.
"Catfish. You can catch catfish on a hook and line."
"Mullet. Never caught on a hook and line."

12.
"Aquarium fish."

13.
(Fish "in the same family". Fishermen who cited "family" or "species" as the major criteria for grouping species together usually had more piles than those who cited edibility, sport, range, or other qualitative criteria such as "bait fish." These fishermen tended to have, one pile called "trouts," one called "flounders" (or "flatfish"), a third called "mackerels," a fourth called "puffers," and so on. Of course, the category "sharks" is a grouping based on similar criteria -- perceived family or genetic relationship. But it has been separated from this "in the same family" category because almost all fishermen in all four areas put sharks together into the same pile.

14.
(Fish the fisherman didn't know)."Don't know, but know they're food fish"

Table B
Criteria By Which North Carolina Fishermen Classify Saltwater Species By Category

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A. Edibility (including species-specific comments about edibility):

1.
"I consider these fish good to eat. I go after them." "Mainly fish I think you'd eat." "Fish I have eaten and know they make good table fare." "Good eating fish that you catch the same way and have the same habits."

2.
"Fish I will eat on occasion. I have eaten them. They're not my favorite, but I will eat them. It depends how full the cooler is."

3.
"Inedible." "These fish are inedible or I don't fish for them. I have eaten shark but I don't target them." "Non-edible species." "Fish I know that aren't good table fare." "Fish I would not eat for one reason or another."

4.
"Dogfish are good to eat."

B. Sport or Fighting Characteristics (including comments about how you catch them or fish for them):

1.
"Striking fish. More or less caught with lures or live baits."

2.
"Serious game fish. You have to have a boat and know about fish, and use heavy duty tackle. Serious fishermen go after these."

C. Range or Habitat:

1.
"Fish caught around the continental shelf. I'm not too familiar with them." "Fish found around continental shelf; catch them off headboats, deep water fish."

2.
"Rockfish." "Reef fish -- coral or artificial reef." "Reef fishes." "Reef fish. Deep water, off-shore bottom fish you find around structure." "Reef, deep water fish that you catch from headboats." "Reef fish."

3.
"Bottom feeders: snappers, groupers." "Bottom fish. Offshore. Mostly you wouldn't catch these from the surf." "Mostly deep-water bottom fish.""Bottom-feeding fish. You're most likely to catch these while fishing on the bottom. Some found in deep water, some in shallow, but all bottom feeders." "Offshore bottom fish, found around obstructions and wrecks, although some can be caught around piers." "Offshore, deep water fish. Mostly variations on the same thing -- groupers, snappers." "Snappers -- caught off headboat, deep, on the bottom, offshore." "Offshore bottom fish."

4.
"Offshore. I'm not too familiar with them. Forty to 50 miles offshore. I don't fish for them." "Blue water offshore species, far offshore."

5.
"Offshore and primarily North Carolina fish. Fish you'd find off this coast."

6.
"Both these fish are caught in warm, shallow, salty water in late summer or the early fall."

7.
"Both caught in late fall and early winter at same places on the Outer Banks."

8.
"Fish you would catch in the surf. Or they inhabit the sound in a large size." "Mostly small fish which you catch in the surf in the summer time especially." "Inshore, pier, surf-casting fish. You'll catch these around inlets, in sounds and bays." "Fish you'd catch around pilings and piers." "Fish caught in surf and offshore a little ways." "Green water, open water, inshore fish." "Little fish you can catch close in." "Inshore, sound fish; readily caught in the same general area." "Surf and small boat fish; inland fish."

9.
"Florida inshore species." "More tropical fish, more acclimated to the Florida area." "Notorious for being Florida fish."

10.
"Fish caught off charter boat, inshore, 10 to 15 miles out. Some come in closer." "Good Gulf Stream, headboat fish."

11.
"Brackish water fish." "Salt and freshwater fish. Some land-locked."

12.
"Fish found either in the sound or in the ocean, but primarily in the estuary."

13.
"Trash fish that you can catch all over, in (shore) or offshore."

14.
"Trash fish. All can be caught off the pier or in the surf -- they're small."

D. Combination Edibility and Sport:

1.
"Easy to catch fish. Most people like 'em and know 'em when they see 'em. Popular, well-known, and edible." "Cooler fillers. Good to eat and fill the freezer. Easy to catch."

2.
"Tunas -- delightful to catch and eat." "Trout -- fun catching, good eating."

3.
"Fish that are more difficult to catch, bigger, that take better tackle. All edible."

4.
"Predator fish which are generally not too good to eat. Good sport fish -- okay to catch, not good to eat. Aggressive fish." "Fish that people release. Sharks and others. People love to fight them, but they're not too edible."

5.
"Trash fish -- I wouldn't eat them." "Fish that ain't good for nothin'." "Pests." "Nuisance-type fish. Fish I'm not interested in." "Nuisance fish you hope you don't catch, pretty common in shallow water. Things you don't want to get."

6.
"Game fish, big game fish, some of them good eating."

E. Combination Sport and Range/Habitat:

1.
"Game fish. You could put sailfish in that pile. I have never caught them. You have to go offshore to get them, except tarpon." "Offshore game fish." "Fish you would hook into on boats, often trolling. Offshore striking fish. Big game tackle fish." "Near(shore) or offshore sport fish. Fish caught between North Carolina coast and the Gulf Stream. Offshore trolling fish." "Offshore game fish. Good eating on the table." "Blue water trolling fish. Offshore game fish." "Big fishin' fish. You got to get out there a ways, mostly, to get them." "Fish that you catch the same way and feed the same way. Offshore trolling-type fish." "Deep water big sporting game fish." "Offshore sportfish."

2.
"Bigger-class sporting fish that you probably find in the same area while fishing for mackerel."

3.
"Principal game fish found aroung surfs and piers. Mackerels, bluefish, drum." "Inshore game fish. Tremendous fight." "Inshore, around beaches and sounds, with a terrific fight and good commercial and food value." "Surf or inshore sports species."

4.
"Florida game fish."

5.
"Boat fish. Offshore sport fish all good sport fish, all good to eat. You catch them by trolling."

6.
"All these fish hang around the surf. You catch them on the same thing. They hang around the sounds, close in. Whiting feed on little animals in the surf, like drum."

F. Combination Edibility and Range/Habitat:

1.
"Groupers and snappers -- food fish. You can catch them in the same areas." "Bottom fish. Drop fish off party boat. Always in schools; okay to eat." "Groupers and such. Bottom and reef fish. Usually big and good eating."

2.
"Reef fish with little or no value, either economically or eating-wise."

3.
"Mostly smaller pan-fish type fish which you catch in the surf, around the pier. Inshore." "Good-eating fish that you easily catch off piers, in channels, with small tackle." "Inshore sport fish, aggressive and good to eat." "Basically reasonably good tasting inshore fish that I will go after if they're there and biting." "Small fish caught in the sounds that I'm not particularly interested in, but have caught and have eaten. Not highly desirable, but not trash fish either."

4.
"In-shore sport fish that feed off bars and are good to eat."

5.
"Fish found basically off the beach around rocks and reefs -- sport, but no food value."

6.
"In(shore) and offshore fish with good edibility but no sport." "Inshore, bottom feeders with good eating and commercial value."

7.
"Inshore creatures with no food value."

8.
"In(shore) and offshore fish you catch around wrecks and reefs. Good eating."

9.
"Miscellaneous edible fish that you catch off headboats, most of which are two to five pounds. You keep them if they're larger."

G. Miscellaneous:

1.
"Sharks -- pest fish -- their skin is hard. I haven't figured out a way to pierce the skin to get to the meat. You can eat them, but I don't." "Sharks." "Sharks and ray." "Sharks and dogfish -- I usually toss them back." "Sharks and ray -- no scales, but skin. Dogfish are okay to eat." "Sharks are all in the same category -- the only one people are likely to run into are dogfish. Lemon, mako, and blackfin are good sport sharks." "Unedible sharks." "Sharks -- when they come, everything else leaves." "Sharks. I've eaten them, but usually don't keep them." "Sharks and dogfish.

Sand and blacktipped edible." "Sharks -- all free-swimming. Pain to clean because they dull the knife, bleed all over the place, and smell like urine. Nine to ten-pound dogfish are pretty good to eat if you get the fillets in the cooler immediately." "Sharks and dogfish." "Sharks." "Shark -- who needs it?" "Sharks." "Sharks, ray, and dogfish." "All sharks, ray -- no skeleton." "Sharks, dogfish."

2.
"Fish picked up accidentally. I don't target them. Scaly fish."

3.
"Sport sharks."

4.
"Pan-fish family."

5.
(Same shape, size, or appearance) "Fish with the same body shape that you find around piers."

6.
"Bait fish." "No good to eat but use them for cut bait." "Bait fish and other miscellaneous species. I can't lump them as far as sport or ediblity go." "Trolling baits." "Bait fish."

7.
"Basically target fish that I go after. I'm more familiar with these." "Premier fish. What I go after and what I think other people go after here."

8.
"Predator fish with similar mouths -- they eat other fish." "Fish that mostly feed on barnacles and mussels." "Fish that feed on hard items, barnacles, etc."

9.
"Mullet: vegetarian. All by itself."

10.
(Fish that are unfamiliar to the fisherman).

11.
(Fish "in the same family." See note for this category in table showing quotes of West Florida fishermen).

Table 14 shows the various responses of Texas fishermen to species during the pile sort tasks.

Table C
Criteria By Which Texas Fishermen Classify Saltwater Species
By Category (n=21)

Category	Specific Criteria	Number Citing Criteria

A. Edibility (including species-specific criteria):

"Good eating fish."

"Good fish to catch, mostly small, but pretty good eatin'."

"Fish you catch, but no one bothers with. They're edible, but not so good to eat." "Not that much fun, but food fish."

"Not desirable fish from the standpoint of eating."

B. Sport, Fighting, or Catching Characteristics:

"Sportfishing fish." "Sportfishing fish." "I like to catch them for sport." "I catch these mostly for sport, and sometimes eat them." "I love shark fishing. But to eat shark, you have to prepare them quickly. Clean and bleed them." "Sportfishing fish I go after primarily for the game of catching them." "Hard fighters -- all hit artificial lures." "Good fish. Fun to catch and good to use for crab meat." "Good sport fish." "Good fighters."

"Tarpon -- fun to catch, nonedible, but desirable because it's spectacular to catch." "Terrific game fish."

C. Range or Habitat (also, habits of the fish):

"Bottom feeders."

"Fish you'd catch bottom fishing offshore. Snappers, groupers."

"I associate these with fish maybe you'd find in the deep sea."

"Fish you don't get around here."

"Open ocean fish."

"Closer-in fish, some near shore but usually in the open bay." "Fish you catch around piers."

"Backwater fish found in flats and river mouths."

"Fish I know from Florida reefs. Either very close in or further out, but mainly around reefs. Also offshore."

D. Combination Edibility and Sport:

"Sportfishing and good food fish. Found mostly offshore." "We like these -- to catch and to eat. These are target fish in Texas." "Game fish and fish you eat." "Fish caught with artificial lures -- all good to eat except ladyfish." "Edible sport fish; some should be regulated." Good sport fish and good eating fish; most are regulated." "All good-eating fish, also good fighting fish."

"Good fish to catch on light-tackle. Also good eating."

"Fairly good to eat, fun to catch."

"Good to catch, maybe they're good to eat, but I don't know."

"Barracuda -- good to eat but possibly poisonous. Fun to catch."

"Trash fish." "Trash and stuff I don't know." "Pain-in-the-ass fish." "Trash fish and bait fish. Some people eat them in Mexico." "Trash." "Fish that you don't fish for for sport or food." "Trash and weird-looking fish." "Trash." "Trash fish -- I never catch a lot of them. The ones I ain't caught. I don't know what they are."

"Fish which are fun to catch but which I don't eat."

"Hard to catch, good to eat."

E. Combination Edibility and Range:

"All bottom feeders. Some inshore, some offshore, but still feed on bottom. All fairly good eating." "All bottom feeders -- croaker, whiting, red drum -- all good eating." "Good eating, good bottom fish that hit dead bait or lures."

"Inshore, bay or surf fish -- I catch them from time to time. All good eating. Shallow water." "Inshore, keeper type fish." "Inland edible fish."

"Good eating fish you catch in the deeper ocean (except sheepshead)." "Exotic offshore fish; edible."

"Streamlined, all good sport fish, not all good to eat, which you catch further out. You troll for them."

"Fish you catch offshore, either trolling or around rigs. Some good eating, some not.""Offshore fish. A lot are quality fish, but this is a mixed group." "Exotic offshore fish; inedible."

"I catch these from time to time when I'm fishing for trout or redfish. They're edible, but not preferable. Not quite trash fish."

"Inshore undesirables. I wouldn't want to catch them or eat them."

"Offshore, surface fish, but I wouldn't keep them."

F. Combination Sport and Range:

"Offshore game fish." "Deep sea sportfishing fish." "Offshore surface game fish. Keep cobia, definately, and now tarpon is coming back. Hell of a game fish."

"Fish that are available inshore, fun to catch, and good to eat."

G. Miscellaneous:

"Sharks." (7) "All sharks." "Sharks, ray, dogfish -- all in the same family." "Sharks -- usually I won't keep them, although the meat looks good." "Primarily sharks and barracuda -- fun to catch but I'd rather not have them on a hook."

"Fish I would be interested in." "Fish I'd like to catch." "Popular fish." (Target, preferred species). "Similar to fish that we catch here. Not necessarily the preferred fish, but mainly just fish we're familiar with."

"Oddball species -- don't know much about them; they're probably not good to eat." "Fish I don't know too much about; if I do, I don't care to fish for them." "Fish I don't know too much about." "I don't know anything about these." "I don't know a lot about 'em."

"Fish I accidentally hook, interesting, but I don't have any use for them."

"Fish that are in abundance here -- bait stealers."

"These look like freshwater fish." "Stripers are good freshwater fish."

"Bottom and flatfish."

"Bait fish." (5)

"Flat fish."

"Stingray -- just avoid. A good sign for trout and redfish."

(Fish "in the same family")

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